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COVER PICTURE

The Rose Mallee, a flowering eucalypt which is ideal for cultivation.
See Trees of Western Australia, Page 583.

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SWINE ERYSIPELAS

A Newly Reported Disease of Pigs in Western Australia

Fig. 1: Typical reddish-purple lesions on the skin of a white pig.

By M. R. GARDINER, B.S., V.M.D., Chief Veterinary Pathologist

RECORDED in Western Australia for the first time last year, swine erysipelas is a potential menace to the pig raising industry. This preliminary description is given to help farmers recognise its occurrence.

It is not known how widespread the disease might be, and farmers' co-operation is needed to estimate its extent. Any suspected cases should be reported without delay.

Swine erysipelas has been known for many years in many parts of the world where pigs are important in the livestock scene. The organism causing the disease—Erysipelothrix rhusiopathiae—was one of the earliest bacteria to be identified at the beginning of the bacteriological era in the 1880's. Since those days a great deal of work has been done, not only on the nature of the disease, and its causative agent, but also on methods of prevention and cure. Today most of these aspects of swine erysipelas are fairly well understood. Research has been intensifying with respect to the reasons for its prevalence in one community and its rarity in another, for its seasonal rise and fall in incidence, and many other facets of the study that we call epizootiology.

LOCAL OCCURRENCE

Our interest in swine erysipelas became more than academic when the disease was diagnosed three or four times in Western Australia in July-August, 1960. We had then the first definite indication of its existence here and learned that this was another disease that could be added to the list of causes of pig mortality. It has also become important to find out how widespread swine erysipelas really is in Western Australia and it is for this reason that we feel that a description of the disease should be presented to pig raisers so that outbreaks which may otherwise remain undiagnosed can be properly identified.

The responsible organism, although only recently associated with its natural host (the pig) in Western Australia, has been known to cause polyarthritis and post-dipping lameness in sheep here for many years. The author isolated the organism, from a lesion on the heart valve of a calf a year before pig outbreaks were seen for the first time. We can, therefore, state with certainty that the bacterium responsible for the disease has long existed in Western Australia, but we have no explanation for the curious fact that while readily producing disease in lambs and possibly other species, the most susceptible species, the pig, was for years not found to be infected.

CAUSATIVE ORGANISM

The bacterium is a very resistant one belonging to that group of micro-organisms known as saprophytes meaning that they exist and multiply in dead organic matter. It especially likes moist

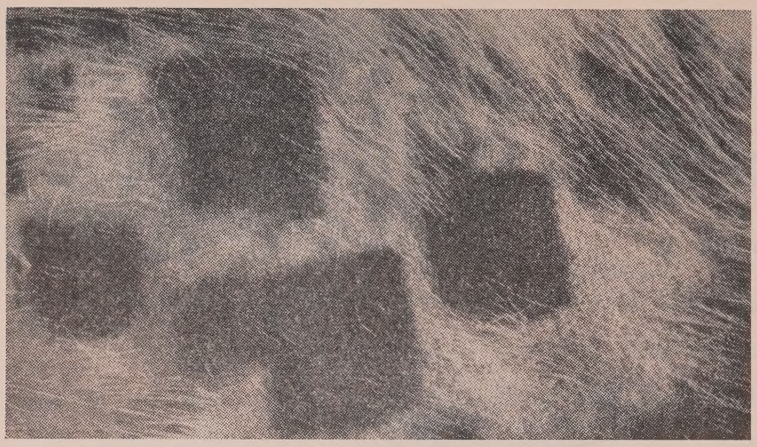

Fig. 2: Reddish - purple patches on the skin approaching the classical "diamond-skin" of acute erysipelas

organic soils, although it will survive freezing, drying and some degree of heat for long periods. Perhaps the diagnosis of erysipelas in Western Australia (Glenfield, Northam, and Armadale districts) during the wet winter months was not just an accidental occurrence, but rather was due to a distinct seasonal rise at a time more favourable to the multiplication of the organism in the soil. However, confirmation of this view is required.

Besides living in the soil, Erysipelothrix is often carried in the tonsils of normal pigs. In fact, Canadian investigations found in 1953 that 30 per cent. of apparently healthy pigs in their survey area were carrying the organism in this tissue. Bacteria which can live in the host in this harmless way and yet occasionally cause serious illness are called opportunists, since they obviously require some modifying circumstances such as another micro-organism or a change in host resistance before they can be said to be responsible for disease.

These modifying factors may operate on the entire herd or only on one or two animals. On the one hand, losses would be serious and the alert owner would seek aid in determining the cause of death, while on the other hand, little attention might be paid to the minor disturbances to herd health and the disease would remain undetected. It is probable that this minor kind of pig loss is the more important in the industry in Western Australia and that this disease seldom causes serious losses. The really important point to be emphasised here is that the bacteria may be contaminating the soils in permanent pig paddocks not only from the natural shedding of healthy carriers but also, enormously, from the occasional pigs that develop the clinical disease and perhaps die or decompose on the premises. In these ways soil contamination is maintained and at times dangerously increased. Once infected a paddock will probably remain so indefinitely if pigs are kept there but the reasons for the ebb and flow of the disease through the years on a property are largely unknown.

The capacity of Erysipelothrix to cause disease in pigs varies, so that on one occasion many deaths result from an organism of high virulence, while on others, organisms of low infectivity predominate, causing few losses. Veterinary scientists in other parts of the world are studying the factors that control the infectivity of Erysipelothrix and any information throwing light on this problem would be of great value to us in Western Australia in understanding such future outbreaks as may occur. In this connection, both soil and climate are probably deeply involved.

THE DISEASE

Severe Erysipelas is a disease which appears in several guises, making its diagnosis difficult in many cases. Perhaps only by laboratory tests can its presence be definitely ascertained. The particular manifestation seen by the owner will depend on factors touched on above, such

as virulence of the organism and the rapidity of soil build-up of the infection as well as the resistance of the pig. This resistance may be general and may be affected by such factors as other infections, nutritional status and climatic stress; or it may be specific, depending upon the animal's past experience with the Erysipelothrix organism. Often the infection may gain entrance through fight wounds or other injuries.

SYMPTOMS

If the combination of circumstances favours a virulent infection in a susceptible pig, onset is usually sudden and death occurs quickly. The affected pig prefers to lie still but can be stirred to activity with prodding, when he shows signs of pain on movement. The gait is stiff and reluctant. If allowed to rest, he will quickly subside into a comfortable but dejected attitude. Appetite is lost and vomiting may occur.

One of the most typical signs of Erysipelas is the presence of reddish to purplish patches on the skin (Figs. 1 and 2). These are slightly raised and firm and usually well defined from the adjacent normal skin. Where the disease is common, the skin form is widely known as "diamond skin disease" because of the characteristic shape these lesions often assume. In pigs which survive this acute type of infection, the skin lesions usually become necrotic and form thick scabs and scars. Such skin changes are similar to the photosensitising lesions of sheep with facial eczema, and frequently occur on the ears and the tail with subsequent loss of the tips. Many pigs may recover from acute Erysipelas although they become unthrifty or unprofitable. Others may survive only to turn into chronic cases, described below.

In the most completely studied of the Western Australian outbreaks—that in the Northam district—the disease picture described above occurred. In fact, due to the absence of previously reported Erysipelas in Western Australia, photosensitisation was first diagnosed. Abortion in pregnant gilts was also seen in this outbreak.

The organism, besides causing this acute systemic infection in susceptible pigs with its propensity for localisation in the skin, has a great affinity for two other tissues—joints and heart valve. In many surviving cases of acute erysipelas involvement of one or both of these tissues will be found. Pigs which have been acutely sick and subsequently become lame, almost certainly have had the disease. The joints particularly the knee, hock and toe, become swollen and painful (Fig. 3). When the heart valves are involved, the animal becomes a hopeless cripple (Fig. 4.)

It must be clear from all that has been said that swine erysipelas is not a simple disease and that it may be easily overlooked, or even mistaken for some other condition. Of course, the same may be said for most of the diseases of the pig. However, I cannot emphasise too much the importance to the pig grower of seeking veterinary aid, not only for the confirmation of erysipelas but also for the recognition of all the predisposing factors and concurrent infections that may be operating in the causation of the outbreak. Most pig diseases require this kind of investigation for satisfactory control.

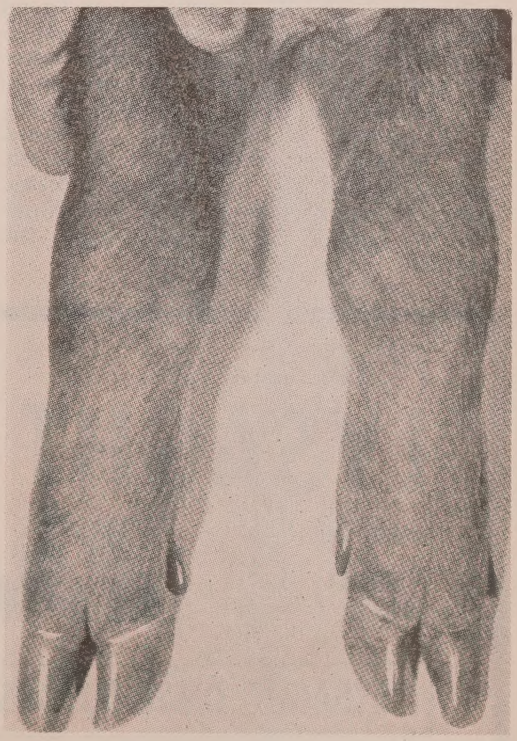

Fig. 3.—Joint swellings in a chronic case of erysipelas

Fig. 4: Nodular swellings "vegetations" on the heart valves of a chronic case of swine erysipelas

In Other Species:

The organism causing severe erysipelas is responsible, in addition to the arthritis in sheep mentioned earlier, for serious disease in turkeys and for a skin disease in humans. The turkey disease is found more frequently in males, and its occurrence is favoured by fighting. It is therefore looked upon as a wound infection in this species. The human infection, known as erysipeloid, resembles the "diamond skin" lesions seen in pigs and is usually associated with the handling of infected pigs or other animals, or with contamination by organic matter containing the organism.

Control:

I will not go into details of treatment or prevention in this article except to say that antibiotic therapy is frequently successful in erysipelas outbreaks and that where the disease is known to occur, the only rational approach is vaccination, which is effective and economical.

ACKNOWLEDGMENTS

Thanks are given to Mr. J. Craig, M.R.C.V.S., Mr. A. W. Williams, B.V.Sc., and Mr. I. J. Miller, B.V.Sc., who participated in the investigations of the Western Australian outbreaks.

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NET BLOTCH OF BARLEY

By THE PLANT PATHOLOGY BRANCH

NET Blotch is the commonest disease of barley in Western Australia, attacking all commercial varieties and causing considerable damage to foliage of maturing crops. Despite its prevalence, net blotch is rarely the cause of a serious crop loss.

The disease is caused by the fungus *Pyrenophorateres* (Died.) Drechsl. and has been recorded only on cultivated barley in this State.

Symptoms.

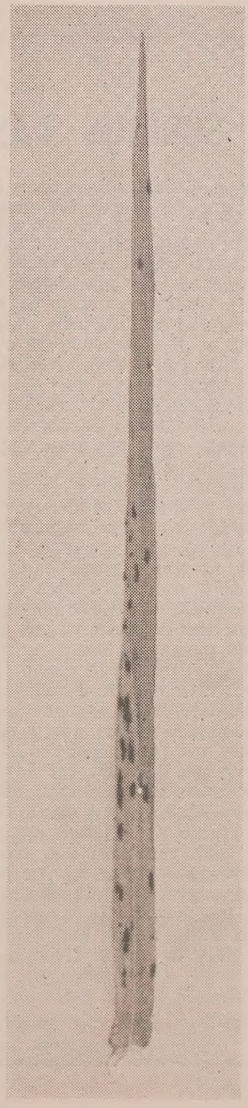
On leaves, net blotch first becomes evident as small brown blotches containing networks of darker, fine lines. The spots enlarge longitudinally and coalesce to form small stripes with irregular margins (Fig. 1). These stripes tend to run parallel to the main veins, and at a more advanced stage, may extend the whole length of the leaf blade.

However, the stripes seldom continue into the leaf sheath, and by this symptom, net blotch may be readily distinguished from the closely related stripe disease *(Helminthosporium gramineum)*.

The disease also affects the floral parts and on the kernels causes indistinct brown spots, which lack the conspicuous networks of leaf blotches.

Carry Over and Spread.

As the net blotch is seed borne, initial seedling infections often arise from the sowing of diseased seed. However, the main carry-over is on diseased crop residues and numerous fungal seeds (spores) are produced on this material during the cool, wet weather, which normally follows seeding. These spores



are carried by the wind into nearby crops and infect the foliage of young barley seedlings.

As the season continues, more spores are produced on the new blotches and the disease spreads through the crops.

Prevention and Control.

(1) Seed should be dry pickled with an organic mercury dust. This will control the seed borne phase of net blotch, as well as that of covered smut.

(2) Diseased residues from barley crops should be ploughed under or burned at the earliest opportunity. This will prevent the production and dissemination of spores during the following season.

(3) If practicable, barley should be grown in paddocks well separated from those cropped with this cereal during the previous year.

SURPLUS PASTURE ON THE DAIRY FARM

THE season so far has been one of the best on record in the South-West, and many dairy farmers now have more feed than their cattle can eat.

The result is that some paddocks have not been grazed since the season opened, and others which have been grazed once should now be grazed again. The time has come to face up to the unusual problem of having too much feed.

Too little grazing is as much a fault as overgrazing, as it can quickly lead to deterioration of desirable pasture plants when such things as capeweed and erodium flourish at the expense of clover. This could become a serious problem on some farms this year, with pasture composition falling off by the end of the season.

To stop feeding hay is *not* a solution to this problem; it will pay to continue to encourage milking cows to eat up to 10 lb. a head a day until the end of August, even though excess pasture is a problem. Hay quality must be good for the cows to eat this much, and if a hammer mill is available it may help to feed hammer milled hay in the bales.

Purchase of extra stock is a good solution to the surplus pasture problem, but one not available to many farmers—either through lack of finance, a shortage of the right sort of animals, or a variety of other reasons.

How to manage the surplus pasture should depend on the composition of pasture in the various paddocks. Often, it may be better to leave some paddocks completely unstocked with a view to cutting for early silage, say in early September. These should be the weedy paddocks which need reseeding anyhow, or those with no weed composition where the desirable pasture plants will not be unduly harmed by undergrazing. The very weedy paddock would be the logical choice.

After cutting for silage the weedy paddock should be mouldboard ploughed and cropped, either to a cereal planted in early September for hay or grain, or a fodder crop such as Sudan grass, planted in October-November. In either case it is then important to reseed early next autumn. Sow useful pasture species, and do not just rely on the clover to come back after the cultivation.

Oats planted dry for early feed have not been as useful this year as in seasons with a later opening, and many farms will have a surplus of this. It will mature too early for hay, but should be ideal for early silage. This silage would be improved if the paddock also had an undergrowth of clovers and grasses, or if the oats was mixed with material cut from an adjacent weedy pasture paddock. When such silage is made layers of the more mature oats could be put under the high moisture content pasture to give better silage quality.

It is important to stock most paddocks to capacity, especially those which contain some weeds but which are not yet ready for reseeding; these are the ones most likely to suffer from undergrazing.

—R. A. BETTENAY.

(From a rural radio talk)

FLEECE WEIGHT —the best culling guide

Flock owners' thoughts are now turning towards culling. Culling should remove the worst sheep and keep the best to fill the bales and breed replacements.

A valuable aid to this annual task is Culling by Fleece Weight during shearing.

Remember when using this method—

(1) Its greater accuracy is proven. Your gains are immediate. The average cut per head is increased and the most profitable sheep kept.

(2) It should be applied to maiden ewes at the shearing before they enter the breeding flock. It would also pay to cull a young wether flock by fleece weight.

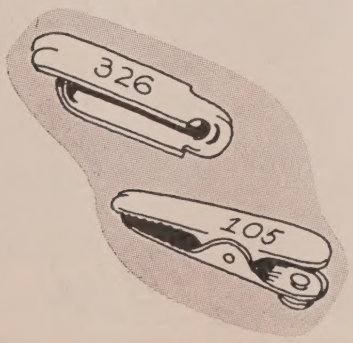
(3) A minimum primary culling is first carried out in the yards to remove obvious culls—deformed sheep, bad mouths, poor conformation, and so on.

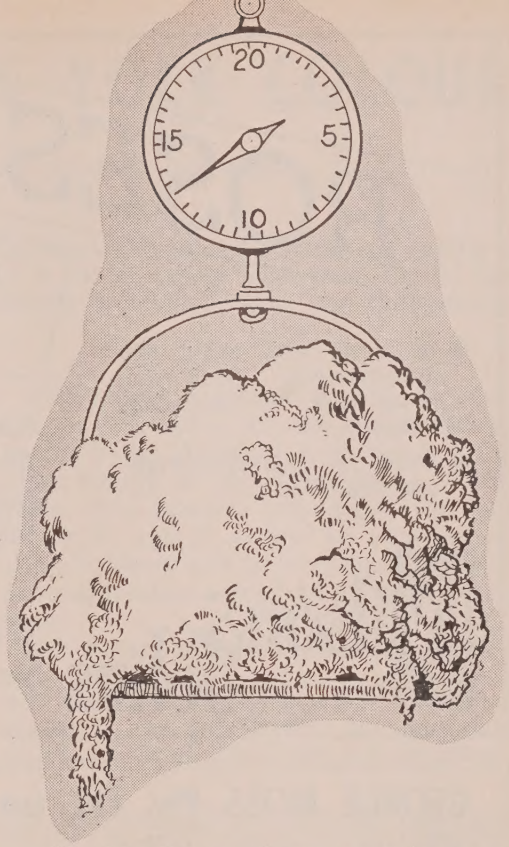
(4) The ewes are identified by numbered ear tags—either permanent plastic or temporary alligator ear-tags.

(5) As the sheep is shorn, the number is recorded on a card.

(6) When finished, the fleece (and belly) is weighed and the weight recorded on the card.

(7) The fleece is then thrown, skirted, and classed in the usual way.





(8) Any fleeces of very poor type are recorded on the card.

(9) When shearing is completed, the lighter cutters and the few with inferior wool are culled according to the percentage you desire to cull, having in mind profitable stocking rates.

(10) To avoid shed confusion, carry out this work at the beginning or end of the main shearing.

(11) It is essential that the sheep are the same age, same wool growth, and have been run under the same conditions.

(12) Mark culls so that they can be identified when it is time for disposal.

Officers of the Sheep and Wool Section of the Department of Agriculture are available to demonstrate and instruct in this technique. Applications for a demonstration should be made to the Officer in Charge, Sheep and Wool Section, Department of Agriculture, South Perth, or your nearest Agricultural Adviser.

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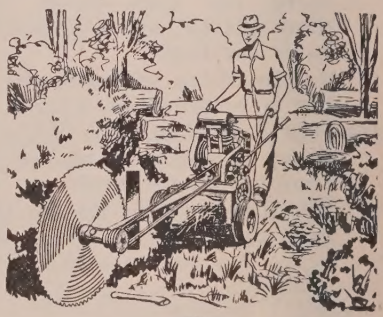

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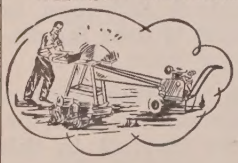

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FEEDING FOR EGG YOLK COLOUR

By P. SMETANA, B.Sc. (Agric.), Adviser, Poultry Branch

ON July 3, 1961, the Western Australian Egg Marketing Board commenced paying a bonus to producers for yolk colour. This is an extremely important step in the marketing of eggs and should have a widespread beneficial effect on the poultry industry of this State.

It is in the interests of all individual egg producers as well as the industry as a whole to ensure that eggs are produced with the desired golden coloured yolks. Farmers stand to gain directly from the bonus paid for eggs with a satisfactory yolk colour and indirectly from increased local sales and more favourable export markets which should stabilise egg prices. Increased local sales and improved export markets are confidently anticipated as the majority of consumers both at home and overseas have a definite preference for eggs which have rich golden coloured yolks.

Yolk colour is almost directly dependent on the nature of the ration fed to laying birds, therefore it is possible for every farmer to control the colour of the yolks. The pigment responsible for yolk colour in eggs is known as xanthophyll and a feedstuff rich in this pigment should be incorporated in the feed at the required level.

The choice of the ingredient used for supplementation in regard to yolk colour will be based largely on the economics involved. In this State the materials which should be considered are greenfeed,

A well-kept Kikuyu lawn provides good quality green feed and makes an attractive setting for the poultry farm. Regular cutting is important

lucerne meal, clover meal and possibly synthetic pigments.

GREENFEED IN LAYING RATIONS

Greenfeed is probably the most satisfactory feedstuff to incorporate into the feeding system for the production of golden coloured yolks. Fresh, good quality greenfeed supplied to laying birds at the rate of one to 1½ ounces a bird a day will be sufficient to produce an egg with the required yolk colour for bonus payment. This amount is roughly equivalent to one handful a bird or 6 to 9 lb. per 100 birds.

Several considerations are important in connection with the feeding of greenfeed. Firstly, only fresh, good quality material should be used. Old rank growth is much lower in nutritive value and will not have the same effect as young freshly cut material.

Suitable Plants:

There is a wide range of plants suitable as greenfeed but the most popular in this State are lucerne and more recently kikuyu grass in the form of a lawn. Although both these types of greenfeed are high in nutritive value, kikuyu has certain advantages which make it ideal for many poultry farms.

A well established area of kikuyu grass serves the dual purpose of beautifying the farm and providing birds with valuable greenfeed all the year round. Lawns should be frequently manured and watered to maintain a quickly growing sward. It is desirable to cut the lawn in strips and each section should be cut once a fortnight. The lawn should be cut with a heavy power mower close to the ground so that it does not become spongy. The clippings must be fed to the birds as soon as possible after cutting as there is a loss of nutrients on storage under ordinary conditions.

It has been found that enough greenfeed to provide for 2,000 layers can be cut with a 24-inch cut mower in about 12 minutes. The clippings thus obtained are in a form which is easily handled and palatable to poultry.

A quarter-acre plot of kikuyu is enough to supply greenfeed for 1,000 birds for most of the year. Perth soils are very suitable for the establishment of this grass.

Besides being extremely valuable in regard to egg yolk colour, greenfeed contains a number of nutrients including a wide range of vitamins. Vitamins known to be present in greenfeed are vitamin A in the form of the precursor carotene, riboflavin, thiamin, pantothenic acid, pyridoxine, biotin, choline, folic acid, vitamin K and vitamin E.

Much has been written about the tonic effect of greenfeed. Undeniably the addition of greenfeed to most relatively simple laying rations has a highly beneficial effect. Repeated experiments carried out at the Poultry Research Station in Wembley have shown that when greenfeed was incorporated into a variety of rations a general improvement in production results, particularly in diets not fully supplemented or on the borderline for efficiency.

It is evident that the inclusion of greenfeed not only improves the yolk colour of eggs but can also be responsible for a definite lift in production, depending upon the ration in use. Another interesting conclusion drawn from the results of experimental work at the research station is that when greenfeed is fed to laying birds from the time of housing in laying quarters, in almost every case there is a rapid and marked response in the first few months, which coincides with the autumn period when egg prices are normally highest. If the control ration (without greenfeed) is well supplemented and correctly balanced the greenfeed group may lose their early advantage but the benefit of favourable prices is still attained. Poorer rations without greenfeed may never make up the deficiency. This point is often overlooked.

Methods of Feeding:

The actual method of providing the greenfeed is important. Allowances should be made so that all birds have an opportunity of eating the required amount. In every flock sociological orders exist, which means that where feeding space is limited the late feeders may be unable to consume enough for optimum yolk colour, while the early feeders eat more than would be normally necessary. This factor could be responsible for some variation in yolk colour, which is undesirable.

Green feed in a suitable form—such as these fresh lawn clippings — is readily eaten by all poultry

Occasionally individual birds seem to have an aversion to greenfeed and will refuse to eat even small quantities. Fortunately these birds are rare and normally birds eagerly await the daily ration of greenfeed.

At present it is difficult to quote accurate figures for the costs involved in establishing and maintaining a greenfeed patch. Obviously there will be some variation from farm to farm, according to particular conditions prevailing at any one place, but in all cases some extra expense is incurred. With the introduction of the yolk colour bonus these costs will be more than covered. Farmers who have already established a successful source of greenfeed will stand to gain the full benefit of the premium.

In order to gain more information on the important factors of costs, maintainance and so on, connected with the establishment of a greenfeed source, investigations in these matters are now in progress and it is hoped that some cost estimates will be available in the future. Already one poultry farmer who is about to plant a kikuyu lawn has indicated a willingness to cooperate with the Department of Agriculture.

ALTERNATIVES TO GREENFEED

Despite the undeniable desirability for all farmers to develop an adequate source of greenfeed, there are cases where this is not possible. Circumstances such as a limited area of land, shortage of water and insufficient labour could mean that an alternative to greenfeed must be sought. One of these alternatives is to feed a ration containing quantities of dried lucerne meal

Lucerne Meal:

Lucerne meal is a widely used ingredient in poultry laying rations. The problems connected with this feedstuff in Western Australia are the relatively high cost and range in quality. Local sources are insufficient to meet demands, which necessitates importation from the Eastern States and a consequent high price. Also the locally produced product tends to show considerable variation in quality from the different sources. Attention to the methods of drying the product would help to overcome this range in analysis. The most satisfactory type of meal is one which has been dehydrated rather than sun cured.

Trials with various levels of lucerne meal in rations tested at the research station have shown that 7 per cent. meal in a diet provides the eggs with a fairly pleasing golden coloured yolk. In these experiments a good quality meal was always used and more recent work by various organisations seems to indicate that a higher level is necessary to ensure satisfactory yolk colour.

To allow for variations in quality it is recommended that a level of 10 per cent. of lucerne meal should be fed in layers' rations. This will probably be the level accepted by feed manufacturers.

Farmers using prepared rations will not be unduly concerned in this matter apart from ensuring that the feed purchased guarantees the recommended level. Where rations are mixed on the farm then quantities of good quality lucerne meal should be included at the rate of 10 per cent. of the mixture.

Higher levels will not normally be required and are not recommended on account of the cost factor and high fibre content. Where limited amounts only of greenfeed are available then lucerne meal may be used at reduced levels to augment the xanthophyll content of the ration. The most practical procedure is to try certain combinations and observe the resulting yolk colour, remembering that an interval of up to three weeks from time of feeding is required before the colour becomes stable.

Lucerne meal is also high in nutritive value. Soil, weather, climate, age, temperature, method of processing and storage all have an effect on quality, and it is difficult to give analysis figures, but a typical sample would contain about 16 per cent. protein and 25 per cent. fibre. In addition lucerne meal contains nearly all the vitamins and minerals required by poultry. It is particularly high in carotene, riboflavin, vitamin K, vitamin E and pantothenic acid.

Clover Meal:

The addition of lucerne meal to some rations will increase the cost of the feed, especially where the meal is not locally produced. In order to overcome this extra cost, trials were carried out to determine the suitability of locally produced clover meal as a substitute for expensive lucerne meal.

It was found that clover meal was satisfactory from a nutritional point of view and also that high levels imparted a golden colour to the yolks. As with lucerne meal, there is a wide range in the quality of clover meal. The analysis of clover meal will show variation according to variety, stage of maturity at time of mowing, conditions of drying and the method of handling. Normal samples have about 10 per cent. crude protein and 20 per cent. fibre.

Clover meal is lower in xanthophyll than lucerne meal and therefore higher levels are required for satisfactory yolk colour. Trials at the research station showed that a level of up to 5 per cent. was required before any marked colour change was detected in the yolk. At eight per cent. the yolks exhibited a fairly satisfactory colour but once again only high quality material was used.

Because of the great variability of samples of clover meal it is recommended that levels in excess of 10 per cent. but not exceeding 15 per cent. be used. A feed with 12 per cent. clover meal should be suitable.

Synthetic Pigments:

Not much can be said about the use of synthetic pigments for egg yolk colour at this stage. Work is in progress at the poultry research station on this subject and information will be published when it becomes available.

Although the importance of good yolk colour had been stressed for many years, a check on a cross section of eggs received by the Egg Board in 1959 showed that less than half had brightly coloured yolks. With the incentive of a bonus for yolk colour, it is hoped that farmers will realise and make use of the benefits to be derived from the production of golden coloured yolks.

SUMMARY

To qualify for the yolk colour bonus, feed:

- **Fresh, high quality greenfeed at 1½ ozs. a bird a day; or**
- **Lucerne meal, at the rate of 10 per cent. of the laying ration; or**
- **Clover meal, at from 10 to 15 per cent. of the ration, depending on quality of the meal.**

Chemical Poisoning

In Animals

By H. D. SEDDON, B.V.Sc.

III—PRUSSIC ACID

HYDROCYANIC or prussic acid poisoning is a serious and not uncommon ailment of ruminants, and may be a cause of rapid death when pasture plants capable of developing dangerous levels of the poison are being grazed.

Many of these plants are valued for their quality and nutritional value. Fatalities from these can be avoided by adopting appropriate methods of husbandry and grazing control.

Sources:

In Australia, the most important source of prussic acid is from cyanogenetic (cyanide producing) plants, particularly in their early stages of growth or regrowth, or following physical damage by frost, disease, bruising and so on. Notable in this group are plants of the genus Sorghum, of which Johnson grass is a notorious example.

Below is given a check list of plants which are capable of developing toxic levels of prussic acid. It should be remembered that the list is incomplete, as there are many species which are only suspected of being toxic from circumstantial field evidence, and have not been proved to be cyanogenetic.

Cyanide poisoning can also result from the ingestion of chemical cyanide compounds, but this is comparatively rare in Australia.

CHECK LIST OF SOME KNOWN CYANOGENETIC PLANTS

Acacia dilatata Benth.

Acacia glaucescens Willd—Sally Wattle.

Acacia longifolia Willd.

Andrachne decaisnei Benth—Andrachne.

Anthemis species—Stinking May Weed.

Aquilegia vulgaris Linn—Columbine.

Brachyachne convergens (F. Muell.) Stapf.—Spider grass.

Brachyachne tenella (R. Br.) C. E. Hubbard—Native or Kimberley Couch grass.

Bridelia ovata Dcne.

Calotis scapigera Hook.

Canthium vaccinifolium F. Muell.—A member of the Madder family.

Chenopodium species—Goosefoots including the Crumb Weeds, and the Fat Hen (known locally as Mint Weed).

Chloris distichophylla Lag.—Winter Rhodes Grass.

Cynodon dactylon (L.) Pers.—Couch Grass.

Dactyloctenium radulans (R. Br.) Beauv.—Button Grass.

Digitaria sanguinalis (L.) Scop.—Summer Grass.

Dimorphotheca species.

Eleusine indica (L.) Gaertn.—Crow's Foot Grass.
Eremophila maculata F. Muell.—Native Fuchsia or Spotted Berrigan.
Eriobotrya japonica Lindl.
Eschscholtzia species—Californian Buttercup.
Eucalyptus cladocalyx F. Muell.—Sugar Gum.
Eucalyptus viminalis Labill.
Euphorbia species—Balsams, Spurges, Caustic Creeper, Asthma Plant, Geraldton Carnation Weed.
Goodia lotifolia Salisb—Clover-Leaved Poison, Clover Tree or Golden Tip.
Grevillea species—Grevilleas.
Gyrostemon ramulosus Desf.—Cork Wood.
Hakea species—Hakeas.
Haloragis species—Raspworts.
Heterodendron oleifolium Desf.—"Minga" (Gascoyne and Murchison Districts) Rosewood.
Hydrangea species—Garden Hydrangea.
Indigofera australis Willd.—Southern Indigo, Australia Indigo.
Lambertia species.
Linum marginale A. Cunn.—Wild Flax.
Linum usitatissimum Linn.—Linseed or flax (Linseed cake, Linseed meal).
Lotus species—Birds Foot Trefoils.
Loudonia roei Schlecht.—Pop Flower.
Macadamia ternifolia F. Muell.—The Queensland Nut.
Nerium oleander Linn.—Garden Oleander.
Panicum maximum Jacq.—Guinea Grass.
Passiflora species—The Passion Flowers and Passion Vine.
Phaseolus lunatus Linn.—Sieva Bean.
Phyllanthus gasstroemii F. Muell.—Lagoon Spurge.
Poranthera microphylla Brongn.
Prunus laurocerasus Linn; Prunus persica Stokes; Prunus armeniaca Linn.—Members of the plum family.
Sambucus nigra Linn.—Elder.
Sorghum halepense (L.) Pers.—Johnson Grass.
Sorghum sudanense Stapf.—Sudan Grass.
Sorghum verticilliflorum Stapf.—Wild or Native Sorghum.
Sorghum vulgare Pers.—Milo or Grain Sorghum.
Trifolium repens Linn.—White Clover.
Trigonella species.
Xylomelum angustifolium Kipp.—The Native Pear or Sand Plain Pear.
Zieria species.

Toxicity:

There is considerable variation in the toxicity at different stages of growth of these plants. It has been shown that there is a higher content of cyanide producing principle in the very young stages of growth and in young shoots or regrowth. Mature plants do not usually contain high levels of the poison. Physical damage, such as may occur with frost, hail, drought, trampling or wilting may also release the poison from the plant cells. Spraying with the hormone herbicides such as 2,4-D, 2,4,5-T and M.C.P. also increases the toxic hazard. Most of these plants contain dangerous quantities of cyanogenetic glucosides only under special conditions, and others, for example White Clover, only rarely.

Fresh growing plants do not contain prussic acid in the free form. It is usually present combined with a sugar to which it is chemically "locked" as a cyanogenetic glucoside. Therefore an enzyme or "key" is necessary for its release before poisoning can occur. In some cases, this "key" is present in the plant or in the animal's rumen (paunch). In other cases, physical agents release the prussic acid in a manner analagous to this "lock" being broken by force.

Poisoning is basically influenced by five factors:—

(1) The amount of plant eaten.
(2) The rate at which it is eaten.
(3) The level of poison it contains.
(4) The presence of an appropriate enzyme or key to release the prussic acid.
(5) The rate at which the poison is de-toxified (rendered harmless) by the body.

The levels of prussic acid vary widely between different plants, between different stages of growth, and between different pastures of the same plant at the same stage of growth. There is no reliable way of being sure that a particular pasture will not be poisonous. Unless the combination of the above five factors pre-disposes to poisoning, animals may graze potentially toxic pasture without ill effects. Therefore, avoiding the grazing of pasture at those stages when it is likely to cause death is the surest way of preventing losses.

Linseed cakes and meals contain residues of cyanide which are normally harmless, since the temperature developed in their manufacture is usually sufficient

to destroy most of it. However, if starved animals are fed on linseed products, poisoning may possibly occur.

Symptoms:

When large amounts of a toxic plant are eaten rapidly, death may occur before symptoms appear. With smaller amounts, symptoms may be seen as early as ten minutes after animals commence grazing, but usually within the first hour.

There is a sudden onset of breathlessness with deep and rapid respiration. The animal goes down and may assume a posture similar to that seen in milk fever with the head turned round towards the flank. Both sheep and cattle are nearly always bloated in the final stages of the condition and the actual cause of death is an internal suffocation, since the tissues are unable to use the oxygen supplied by the blood. Death follows after a short period of convulsions.

If less than the toxic amount of prussic acid is released or eaten, these symptoms will be prolonged and the animal may recover. The mucous linings of the mouth and the eyes will at first appear bright red, later changing rapidly to the purple-blue colour so typical of cyanide poisoning. The smell of "bitter almonds" may sometimes be detected in the breath. Diarrhoea occasionally results from an irritant gastroenteritis.

Laboratory confirmation of toxic levels of prussic acid may be made if from 4 to 8 ozs. of fresh green plant specimens or rumen (paunch) contents are immediately forwarded, tightly sealed or corked in a clean airtight bottle, to the Animal Health Laboratory, Department of Agriculture, Jarrah Road, South Perth.

Post Mortem:

When the blood vessels are cut at post mortem, the blood shows a characteristic cherry red colour on exposure to air. Small haemorrhages are often seen in the lining membrane of the windpipe and larger air passages and there may be a frothy blood-stained discharge from the mouth. Congestion and haemorrhages on the lungs and inner linings of the abdominal wall may also be seen, and this is usually accompanied by bloating of the paunch.

When plants containing high levels of cyanide are eaten, there may be severe inflammation of the abomasum (fourth stomach) and the first few feet of small intestine; this is indicative of a gastro-enteritis. The aroma of "bitter almonds" may be noticed arising from the contents of the first stomach.

Treatment:

Usually death ensues so rapidly following the first appearance of symptoms that nothing can be done. However, the treatment of surviving animals should be started immediately, giving priority to those showing less severe symptoms, and to pregnant and valuable stock. Urgency of attention is essential since any waste of time may mean the difference between life and death. Veterinary assistance should be sought wherever it is available. Nevertheless animals exhibiting very severe symptoms will probably die despite treatment.

All livestock should be moved from toxic pasture immediately, preceded by treatment if necessary.

Compounds of sulphur have been shown to be the main chemicals involved in the conversion of cyanide to non-toxic forms. Drenching with sodium hyposulphite (photographer's hypo) in water provides an extra source for the detoxification process.

The dose of "hypo" for cattle is two ounces dissolved in one pint of water, but sheep should be given only one fifth this amount. This drench should be repeated in half an hour if symptoms do not abate.

Should bloating occur and swallowing become difficult, relief may be obtained by puncturing the left flank with a trocar and cannula, and subsequently administering the "hypo" directly into the rumen through the cannula.

The subcutaneous injection of sulphuric ether has also been used in the treatment of prussic acid poisoning, a 10 cc. dose being administered to cattle and a 5 cc. dose to sheep. The dose can be repeated in 30 minutes if necessary.

Prevention:

Since it is the early stage of plant growth which is toxic, the grazing of this should be deferred for six to eight weeks. Where conditions such as rapid regrowth,

hail, or wilting have increased the risk of poisoning, grazing should be avoided or preceded by feeding good quality hay or crushed grain. A pilot group of less valuable stock may be used to test the pasture, and the observation of these animals for a few hours will serve as a guide to toxicity. They should be removed and given attention at the first signs of bloating or difficulty in breathing. It is also advisable to have on hand a quantity of sodium hyposulphite for treatment purposes.

The dried hay from these pastures is not usually toxic.

References:

Gardner and Bennetts.—"The Toxic Plants of Western Australia" (1956) W.A. Newspapers Ltd.

Hungerford.—"Diseases of Livestock" (1953) 3rd Ed. Graham Book Co.

GROW BETTER BACON

PIG raisers can learn a great deal about producing better bacon by entering the annual Baconer Carcass Competition.

What makes this competition so important to commercial growers is that a pig good enough to win the competition will be good enough to bring top prices when sold.

The display this year will consist of a side and separate ham end from each prize winning entry, and a separate ham end from every other carcass entered.

The usual function at the West Australian Meat Export works will be held on Friday September 15 instead of the Friday of Royal Show week. Growers are urged to attend this, as the display and talks on the standard of entries are possibly the most useful aspects of the competition.

The weight range of carcasses is particularly important. This has been laid down as from 120 to 126 lb. chilled dressed weight, and carcasses outside this weight range will be disqualified from judging.

This chilled weight range should be achieved if entries are forwarded within the liveweight range of 170 to 200 lb. On the basis of killing out at 72 to 73 per cent., pigs slaughtered within this range should comfortably conform to the required standard.

A wise precaution is to weigh the pigs before sending them to the treatment plant—if scales are available.

Pigs entered for the competition must be sired by pure bred boars, although the sows need not be pure bred. Each competitor may submit two entries, and awards will be made to the 10 highest scoring entries.

The basic aim of this competition is stimulate pig raisers to produce a top quality product, to be appraised under an approved system of judging. The results help the grower to make a fairly accurate assessment of the standard of management, feeding and husbandry needed to grow a pig whose carcass conforms to the required standard.

As well as allowing the grower to see how his pigs are doing on his own farm, the competition gives him a chance to compare his product with the best—those which bring the top prices. He also gets a better idea of what the processor wants.

Entry forms are available from the Australian Meat Board office, the Department of Agriculture, and your District Adviser. Receival of entries continues until August 26, and all entries this year will be received and treated at Watsons' bacon factory, Spearwood.

Well kept strawberry beds in a local garden. Moisture requirements are provided for on this property by permanent sprinkler irrigation and a reliable water supply. Note that this grower uses a "double row" planting system

Strawberry Culture

By K. T. WHITELY, B.Sc.(Agric.), Adviser, Horticultural Division.

WHETHER fresh or preserved, the strawberry finds universal favour and is regarded more or less as a luxury. For the grower it offers the quickest cash return of all fruits, cropping in the first year. It is, therefore, very useful to a man trying to establish a fruit growing property with limited capital.

SUITABLE LOCATION AND SOIL

Because the strawberry is one of the first fruits to blossom, and because the blossoms and small fruits can be damaged by frosts, a comparatively frost free situation is a distinct advantage.

Adequate means of access to market with the minimum of rough handling, expense or delay is another factor of importance.

Birds can be troublesome but if the planting is near the house they can be easily scared away.

A good water supply for irrigation is essential.

Although strawberries will grow in a variety of soils, good drainage is essential. A good topsoil containing plenty of humus and a retentive but well drained subsoil are the ideal combination and most local growers use a peaty type of soil. Where this is not available, in which case the soil is usually of a sandy texture, the application of heavy dressings of organic manures is necessary. Animal manures, green manures

(lupins, etc.) and compost are all suitable.

Where possible virgin land should be used, as there is less likelihood of loss from diseases and pests, and weeds are less troublesome.

PREPARATION OF THE LAND

It is important to have the land thoroughly prepared before planting.

All persistent weeds, such as couch and paspalum, should be eradicated by suitable cultivation. Rotary hoeing under hot dry conditions is usually quite effective in this regard.

FERTILISER APPLICATION

The manuring of strawberries is greatly dependant on the nutritional level of the soil, but the following quantities should give satisfactory results:—

(1) Animal manures at approximately 10 tons an acre.
(2) Blood and Bone at approximately 1 ton an acre.
(3) A mixture of 3 cwt. Sulphate of Ammonia, 6 cwt. Superphosphate, 3 cwt. Potash at the rate of 12-15 cwt. per acre.

On soils tending to be too acid, such as the peaty soils, the substitution of urea or nitro-green for the sulphate of ammonia is strongly recommended.

Note.—One ton of fertiliser an acre = ½ lb. per square yard. Ten tons to the acre = 4½ lb. per square yard, or 1 lb. per plant at 20,000 plants an acre.

Approximately three-quarters of the fertiliser should be applied two or three weeks before planting, and worked into the soil. The balance is used for top dressing the plants just before mulching.

If the land has previously been heavily fertilised for quick-growing vegetable crops, such as lettuce, beetroot and beans, the grower must to a great extent use his own judgment in assessing the fertility of the soil and the necessary manurial dressings.

VARIETIES

Pride of the West is the variety most popular with growers in this State at the moment. It bears well under our conditions and the berries are of good size and flavour.

Melba is another variety which is grown, but to a lesser extent. Climax, an English introduction, is being grown but has not been fully evaluated; elsewhere it is known to suffer from a physiological condition known as June Yellows.

Recently the Queensland variety Phenomenal has been showing good promise at Carnarvon and this variety seems best suited to sub tropical conditions.

PROPAGATION

Planting material should be obtained from a selected area reserved from the

Healthy planting material allows the production of good vigorous plants

previous crop for runner production. With proper care about 1,500 plants yield enough runners to plant one acre. Vigorous plants, true to type and free from disease should be the goal and rigorous rogueing will do much to attain this.

To encourage the production of sturdy, well-rooted planting material, the runner bed must receive proper attention, which will include additional topdressings of fertiliser and regular weeding.

If the soil is at all dry, watering the beds before removing the runners will facilitate digging. In order to avoid injuring the plants, it is best to commence digging the runners at some given point and work through the area on a face. The runners are lifted carefully and separated with a small trowel or a strong bladed knife, the roots being trimmed to about 3 in. and all broken and dead leaves removed. A few of the older leaves also may be removed to lessen transpiration after planting, but excessive leaf pruning is undesirable as the plants may take a long time to become established.

After trimming the runners should be placed either in a bucket containing a little water, or between wet bags, and protected from both wind and sun. As far as practicable, no more runners should be dug than can be replanted on the same day.

In choosing planting material the first or second shoots on the runner generally are strongest and should be selected, though it is not always possible to sort them from the others.

TIME OF PLANTING

Planting is usually carried out in May or August, depending on conditions. On the lighter sands May is favoured but on peaty soils August planting alleviates the need for winter weeding.

PLANTING

A good working distance is to space the plants from 2 ft. to 2 ft. 6 in. between rows and 12 to 15 in. between plants. For 2 ft. x 12 in. planting 21,780 plants per acre are required while at 2 ft. 6 in. x 15 in. 13,940 plants per acre are needed.

The plants are most easily put in with a small trowel. The long roots are trimmed and the old leaves cut back to leave three centre leaves. Depth of planting is important and the crown of the plant should be set just above ground level to allow for subsidence. The earth is pressed firmly around the base and the plant given a light watering to settle it in.

Good material planted at the correct depth. Allowance has been made for subsidence

MULCHING, TOP-DRESSING AND WATERING

When the plants have set their first blossoms is an opportune time to give the bed a top dressing of fertiliser, as previously suggested. This should be spread evenly between the rows, then worked in.

The plants should then be mulched with straw, seaweed or sawdust. This protects the berries from injury from contact with the ground and from being splashed with dirt by rain or during irrigation. It also prevents excessive heating of the soil and conserves moisture near the bushes.

When the plants are cropping it is essential that they should receive sufficient moisture, and on no account should they be allowed to show signs of stress. A test of the soil should be made from time to time to ascertain the depth of soil moisture and additional water supplied as required, ensuring that the whole of the root zone is wetted.

PICKING

For most varieties blossoming and fruit set begins in early spring. The main strawberry crop ripens from August to December with a peak about October-November. Stalks should remain attached when the berries are picked, and careful

Mulching with material such as seaweed or straw protects the berries and keeps the soil near the plants moist and cool. The variety is Climax.

handling is essential. Over-ripe and soft berries are unsuitable for marketing and at the height of harvest plants should be gone over every day.

TREATMENT AFTER HARVESTING

When the plants have finished fruiting for the season, it must be decided whether the bed is to be kept for another year or discarded. It is general practice now not to grow strawberry beds for more than two years, as diseases and pests usually take heavy toll of the plants after the second year.

If the plants are to be grown on they should not be allowed to dry out and if required for further berry production all runners should be removed. Should the beds be used for propagation purposes, however, the soil between rows should be loosened up with a fork, lightly fertilised and well watered to stimulate the development of well-rooted plants. When these develop they should be removed in the

Propagating beds should be kept free of weeds and active runner production encouraged by adequate manuring and watering

manner described above and transplanted.

If the plants have been mulched, weeds will not be very troublesome during the winter.

During July and August the plants should be prepared for the succeeding season. All the old dried up leaves should be removed and if the crowns are too packed they should be thinned out. Any weed growth should be chopped in with the rotary hoe or chipped off with a hand hoe. A dressing of blood and bone at the rate of 15 cwt. to the acre or an adequate dressing of poultry or stable manure as indicated above should be spread evenly between the rows and dug in. The bed should then be kept in good order until mulched.

DISEASES AND INSECT PESTS

Leaf Diseases:

The two most common leaf diseases are leaf spot and leaf scorch. Both are characterised by leaf spots, and frequently death of leaves. They are both controlled by spraying with Bordeaux mixture 4-4-60 or Zineb at 2 lb. per 100 gallons of water before flowering and after harvesting is completed. Two sprays give commercial control in normal seasons but in wet years additional sprays are needed.

Grey Mould:

Grey mould frequently causes rotting of berries after rain, particularly when plants are very vigorous and leafy and when the ground between them is weedy. Spraying with Captan at 2½ lb. per 100 gallons of water gives some control in other States.

Thrips:

Thrips may damage blossoms in some seasons, causing distorted fruits to develop. Spraying with emulsion type DDT at blossoming is effective against thrips, but several sprays may be needed to cover the full blossoming period.

Other Pests:

For the control of the Black Beetle larvae which damage the roots of strawberry plants and to control slugs and beetles, ground spraying or dusting with dieldrin on either side of the rows is effective. However, this should not be done within a month of harvesting.

Viruses:

The crinkle and yellow edge virus diseases are a problem in strawberry plantings. They are transmitted by runners from infected plants and by aphids. Control therefore depends on propagating with only healthy runners and by keeping aphids in check.

WOOL CLASSING TIME

Adequate clip preparation always pays big dividends. When classing your clip, remember:—

(1) Avoid overskirting; skirting is to remove wool that is basically inferior to the rest of the fleece.

(2) Fold fleeces twice from one side before rolling.

(3) Roll from breech end to shoulder.

(4) Let 30 or 40 fleeces accumulate before you set the lines.

(5) Match your fleeces into as big and even lines as possible. Keep stains out of all lines.

(6) The first impression is the best.

(7) Keep outsort fleeces in the Bulk Class (B/C) Bin, and out of the main lines.

(8) Have wool bins clearly labelled.

(9) Suggested lines for your clip are readily available.

(10) Standard bale markings are recommended.

(11) Brand bales correctly.

Woolclassing is demonstrated at sheep and wool refresher schools held in country districts. If demonstration and instruction is required, early application should be made to the Officer in Charge, Sheep and Wool Section at the Department of Agriculture, South Perth, or your nearest Agricultural Adviser.

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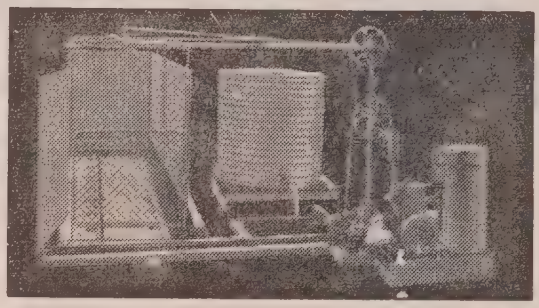

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TREES of Western Australia

By C. A. GARDNER

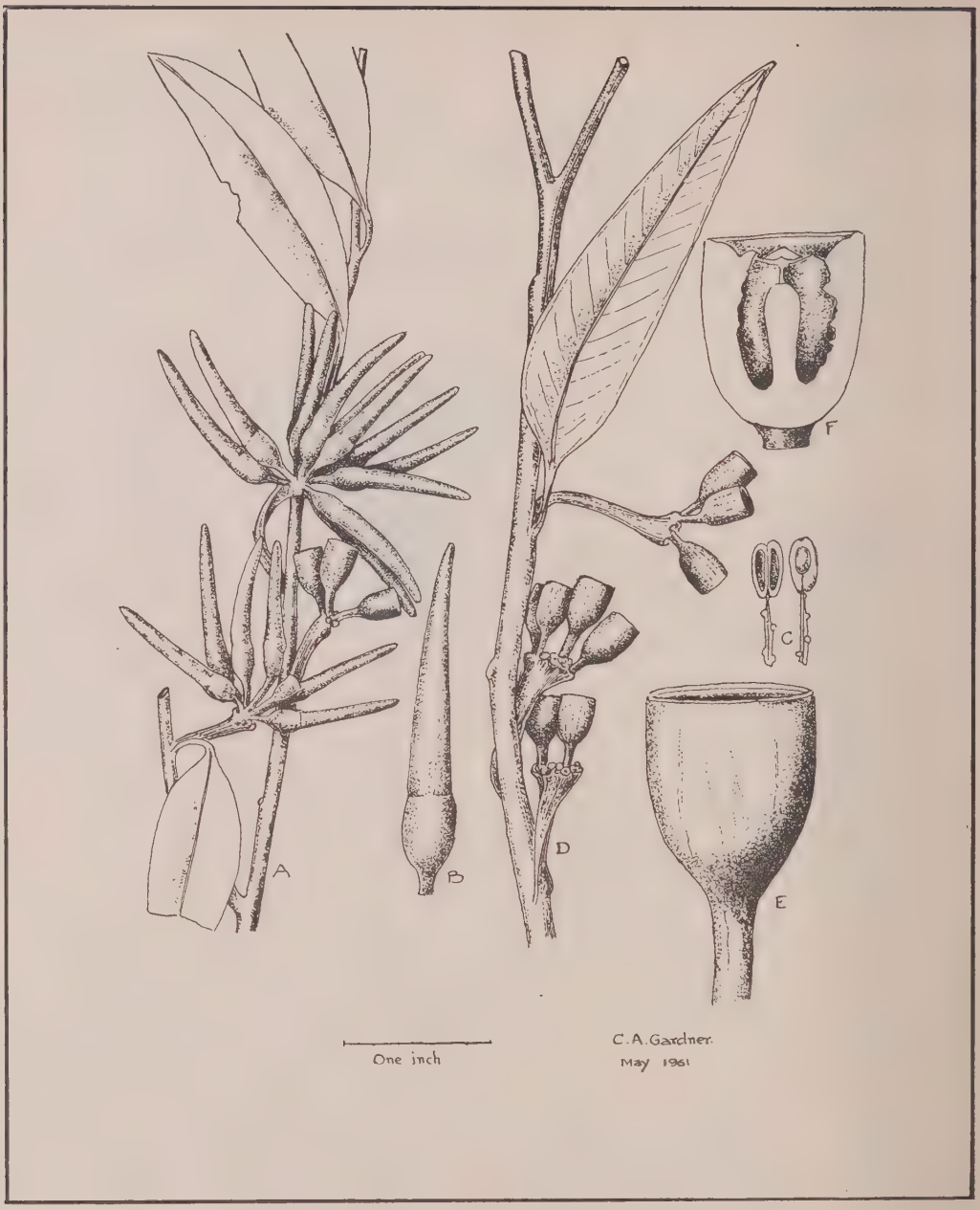
No. 87—EUCALYPTUS KRUSEANA F. MUELL.

THIS very decorative shrub was described by Baron von Mueller in the Australian Journal of Pharmacy in 1895 from specimens collected in the Fraser Range, which lies some distance eastwards from Norseman. It remained little known until it was again collected by Henry Deane, consulting engineer for the trans-Australian railway in May, 1909, from one area seen between 50 and 150 miles eastwards from Kalgoorlie. Deane's specimen was named Eucalyptus Morrisoni by Maiden, who was apparently unaware of Mueller's earlier description. Since then it has been collected from eight miles north from Karonie, and from near Lake Cowan. The species appears, therefore, to be found in a few isolated spots eastwards from Kalgoorlie and Norseman.

Eucalyptus Kruseana appears to have no distinctive common name and would be best called Kruse's Mallee, after its discoverer. The name "Bookleaf mallee" which has a certain use is without tangible meaning.

The plant is described as a shrub six to 10 feet tall, but under cultivation it attains a height of 12 to 15 feet with usually a single stem and more or less horizontally spreading branches densely foliaged with circular grey-green or grey stalkless leaves which more or less embrace the branch at their bases, or are almost kidney-shaped. This type of leaf is not common in Eucalyptus, and this feature together with their small size, renders the species at once distinctive. The bark of the main stem is much like those of some other species of Eucalyptus which inhabit the stony outcrops of the arid interior, *Eucalyptus crucis, E. orbifolia, E. Ewartiana E. Websteriana* and a form of E. *Drummondii.* It is a peculiar bark in that the outer layers, reddish-brown or cinnamon coloured, separate from the pale green inner bark in long strips with rolled edges, thus exposing longitudinal rows of the pale green inner bark. It is curious that this type of bark should be characteristic of those species which inhabit granitic or lateritic outcrops. The flowers are yellow in colour in umbels which exceed the leaves in length, and are quite attractive although not very large. Without any close affinities, this plant can at once be recognised by its small crowded grey leaves and unusual habit of growth.

In recent years the species has attained some popularity locally as a decorative shrub, growing well in the light sand of the west coastal regions, but it is equally at home in the clay soils of the interior, and is suitable for garden planting throughout the agricultural districts at least as far south as Bruce Rock.



EUCALYPTUS MACRANDRA F. MUELL. EX BENTH.

A—Branchlet with flower-buds and leaves; B—Flower-bud (enlarged); C—Anthers; D—Branchlet with fruits; E—Fruit (enlarged); F—The same in longitudinal section. Hamersley River, Gardner, January, 1935

No. 88
EUCALYPTUS MACRANDRA F. MUELL. EX BENTH.

THIS species is of southern distribution, extending from the Stirling Range in the west and eastwards as far as the Phillips River where it is found in sandy loamy soils, usually in depressions or on the banks of streams. It is most common along the Fitzgerald River and its tributaries.

Originally collected by George Maxwell in this general area of distribution it was named by Mueller, but published by Bentham in 1867 in the *Flora Australiensis*. The name is derived from two Greek words *makros* long, and *ander* (*andra*), a man, in reference to the long stamens—the stamens being the male organs of the flower. It thus received the vernacular name of "Long-flowered marlock" from Blakely, but the name is inappropriate, firstly because the flowers are no longer than a number of other species, especially the Yate and its relatives (of which this is one) and because it is not a marlock. The name marlock has been proposed for those species of Eucalyptus which are shrubby but not mallees, i.e., which do not possess woody stock-like bases from which a number of stems arise, these being mallees. As a matter of fact there is rarely such a distinction in the shrubby species of Eucalyptus, and as previously remarked in this series, the mallee form of growth is frequently if not usually the result of circumstances affecting the growth of the plant, amongst which fire is an important factor. The bushman would call Eucalyptus macrandra a Yate of some sort, and the name River Yate would not be inappropriate. It does in fact belong to that group of species which includes the Moitch, the Yates, the Mallets and the Moort—the *Coruntae,* in which the stamens are erect (not incurved) in the horn-like bud-cap.

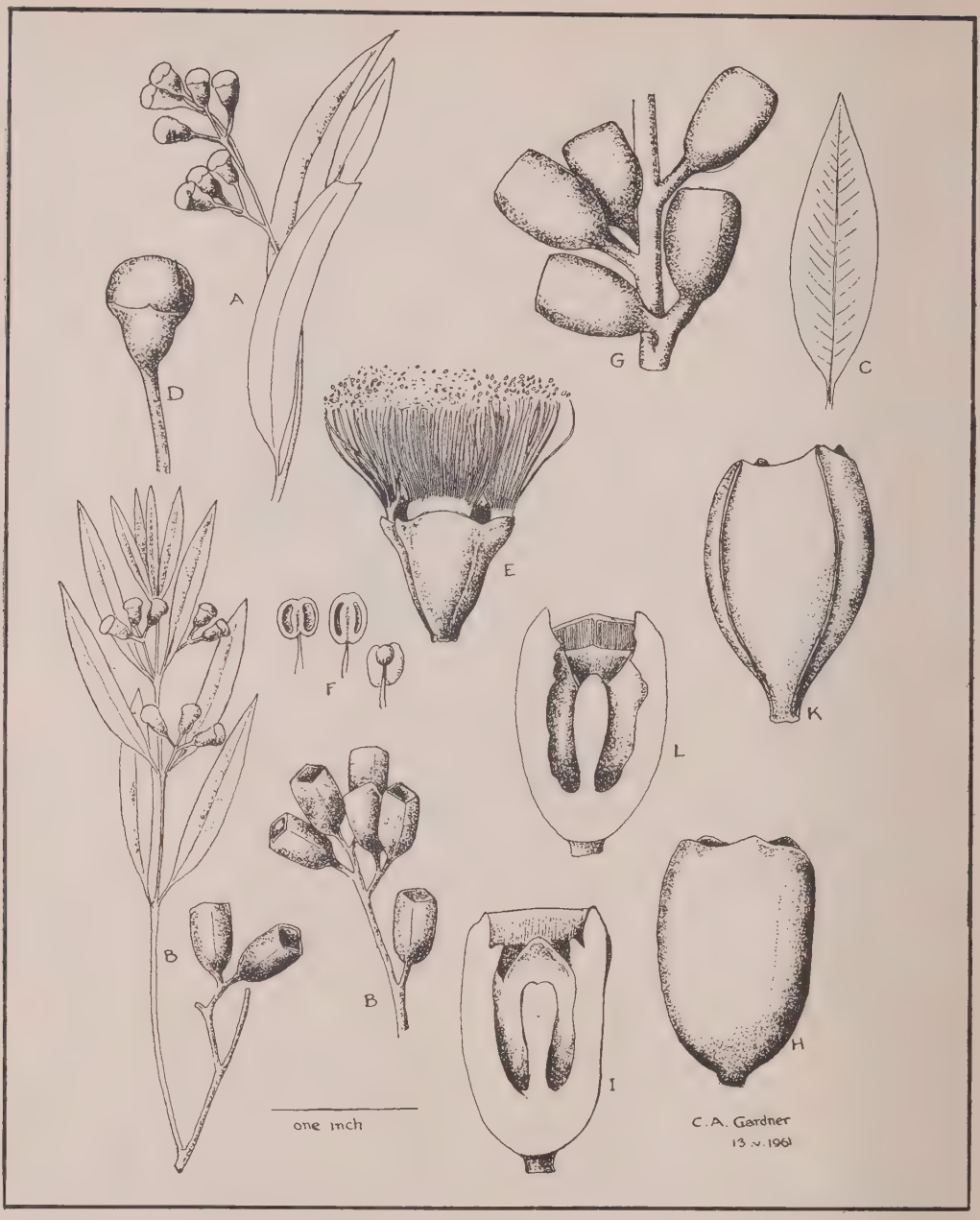
The principal characteristics of this species are the long narrow horn-like bud caps, the stalked buds and fruits, the flattened common flower-stalk (peduncle) and the numerous (up to 16) flowers in the umbel together with the narrow-rimmed fruit with included obtuse valves. The leaves are relatively large, rather thick and lustrous, and particular notice should be paid to the shape of the fruit, together with the nature of the valves and their position. A comparison should also be made with No. 81 (*Eucalyptus eremophila*)—a mallee with olivaceous leaves, a different disc and valves, and non-glandular filaments. *Eucalyptus Stowardii* (No. 80) has ribbed buds and the fruits are sharp exserted valves.

Although in its natural habitat it favours the banks of streams and depressions, it has proved hardy in cultivation in the drier districts. Mr. Edward Gardner raised the tree from seeds in the Tammin district, where it attained a height of 15 feet in less than five years, and it flowered very freely. The filaments are yellow. The plant should be of interest to the apiculturist, having many of the features of the yate, but of more rapid growth and free flowering. It flowers from January to March.

No. 89—"MALLALIE"
(*Eucalyptus eudesmioides* F. Muell)

THE names "Desert Gum" or "Desert Mallee" sometimes given to this species are not applicable, for the species does not occur in the arid interior. The name "Desert Gum" should be reserved for Eucalyptus gongylocarpa which is indeed a tree of the desert.

Eucalyptus eudesmioides is a mallee, or very rarely attains the proportions and stature of a small tree. The first specimens to be named were collected by A. Oldfield and P. Walcott on the sandplains of the lower Murchison River and at Mount Curious which lies immediately north of this river. The range of the species as known at present extends from about half way between Northampton and Shark Bay in the north, to Walebing and Piawaning in the south, whilst to the east we find it as far inland as Perenjori and Eradu, as a small bushy mallee with an average stature of about six or eight feet



"MALLALIE"

(Eucalyptus eudesmioides F. Muell*)*

A –Branchlet with leaves and flower-buds; B—Branchlet with leaves, flower-buds and fruits; C—Leaf; D—Flower-bud (enlarged); E—Flower (enlarged); F—Anthers, Mingenew, Gardner 690; G—Fruits; H—Fruit (enlarged); I—The same in longitudinal section, Walebing, Gardner; K—Fruit (enlarged); L—The same in section, Hill River, T. N. Stoate 22

with a pale pink, or yellowish-pink bark, the outer bark shedding in dark grey plates. The leaves are opposite, usually glaucous and thin, and distinctly stalked, but in the northern extremity of its range we find mallees with deep green larger and quite lustrous leaves. The flowers are always in umbels of three, on slender stalks collected on a common peduncle or common stalk. The hypanthium is campanulate or bell-shaped, and is four-toothed at the top, and the broad obtuse operculum is broader than the hypanthium. The filaments are white, and arranged in four distinct groups or bundles with a claw-like base (see Fig. E), and the anthers are rather short and broad. The only other South Western species with a similar staminal arrangement are *Eucalyptus erythrocorys* (No. 4 of this Series), *E. tetragona* the Tallerack (No. 71), and *E. ebbanoensis*. This group represents primitive forms of the species of Eucalyptus.

Eucalyptus eudesmioides is the "Mallalie" of the Murchison aborigines, according to Oldfield. Wherever possible Oldfield seems to have obtained the native names for native species and it is to be regretted that other collectors did not do the same.

The mallee grows on poor sandy or sometimes lateritic soils, and restricted to the area outlined above. It flowers from January to March, and is a hardy species in cultivation. I would recommend it for planting in exposed situations near the western seaboard.

Although in the middle areas of its range it maintains a fairly constant character, in the north, as stated, it has larger fruits and green leaves (probably the typical form). The common form of the intermediate regions has thinner usually pale foliage and smaller fruits (e.g., Fig B). In the Hill River district we find another form with fruits like those found in the North but more angular, and thick, but perhaps more glaucous leaves. In case of any doubt one should examine the arrangement of the stamens.

If the leaves are mainly opposite (not exactly a reliable characteristic since in the northern and Hill River forms they are sometimes alternate) and the fruit 4-angled and longer than broad with the valves not protruding, the plant will be *Eucalyptus eudesmioides*.

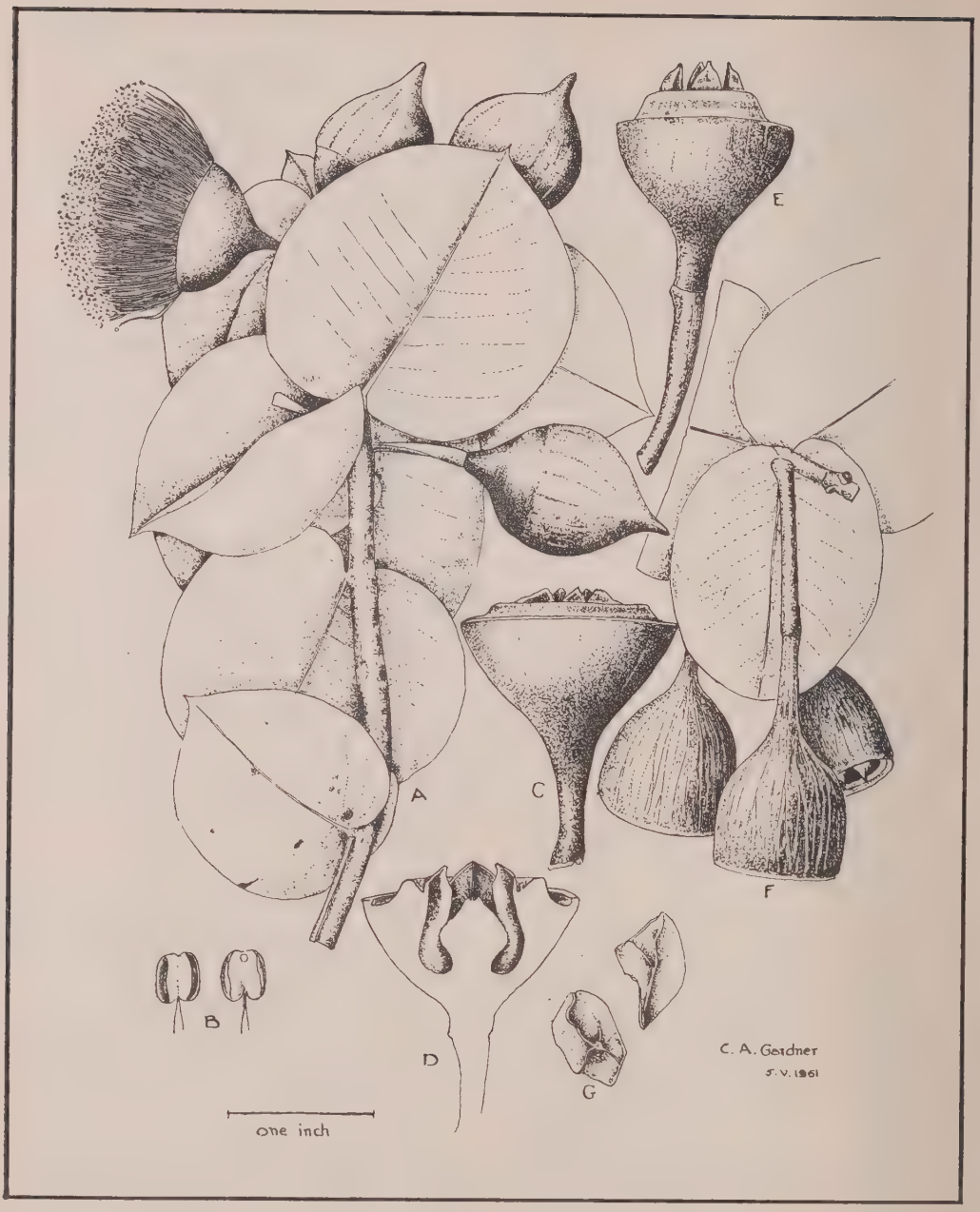
No. 90—THE ROSE MALLEE
(*Eucalptus rhodantha* Blakely and Steedman)

FORMERLY looked upon as a variety of Eucalyptus macrocarpa but distinguished primarily by its stalked flowers, this handsome species was named from material collected near Gunyidi by H. Steedman in December, 1934. I am including it as a species in this series, but examinations made recently in the field over a fairly wide area indicate that it is a variable plant, connecting on the one hand with Eucalyptus macrocarpa, and on the other with Eucalyptus Carnabyi (No. 68 of this series) through the variety petiolaris of E. rhodantha.

Eucalyptus macrocarpa has practically stalkless solitary flowers and stalkless leaves, but its bud-cap or operculum undergoes considerable variation in the area of its distribution. *Eucalyptus rhodantha* has conspicuously stalked flowers in general, but here and there on many plants we find stalkless, or practically stalkless flowers, which are typically solitary, but again, here and there we find two flowers on the very short stalk.

The leaves vary from orbicular and stalkless, to broadly ovate and stalked, or ovate-lanceolate and stalkless or stalked. The fruits are generally smaller than one finds in *Eucalyptus macrocarpa*, and exhibit a greater degree of variation in the disc than is usual in the latter species. I have illustrated only three types of fruits—all from the Watheroo district where hundreds of specimens were recently examined. Figures A to D show the common form; E is a smaller fruit with much more prominent raised disc and exserted valves reminding one of *Eucalyptus Oldfieldii*, while F shows a form with drooping fruits of even smaller size and a very narrow disc. In addition, but not figured are practically stemless fruits which as stated vary from one to two on the extremely short stalk.

If one remembers that *E. macrocarpa* sometimes has a rather long conical oper-



THE ROSE MALLEE

(Eucalyptus rodantha Blakely and Steedman*)*

A—Branchlet of the typical form with leaves, flower-buds and one flower; B—Anthers; C—Typical fruit; D—Section of same; E—Smaller fruit with much exserted valves; F—A form with smaller leaves and pendulous smaller fruits with narrow disc; G—Seeds

Watheroo, Gardner 12780, February, 1961, except Fig. F, which was collected by A. J. Gray in the same area, 1960

culum, and compares the drawings of *Eucalyptus rhodantha* and *Eucalyptus Carnabyi* (*Eucalyptus macrocarpa* will be dealt with in the next issue of this series) it will be apparent that there is little difference between the three, bearing in mind that the variety *petiolaris* of *E. rhodantha* has stalked leaves. All three have red, or yellowish-white filaments.

Notwithstanding this variation, I have for the present regarded *E. rhodantha* as something distinct, whether as a species or a variety, and it is a plant that is almost unsurpassed for cultivation. Typically it is a shrub four to eight feet tall of greater diameter, but frequently we see specimens over 18 feet in height. The leaves are usually shorter and smaller than those of *E. macrocarpa*, and the plant does not appear to be affected by insect attacks as is so frequently the case with *E. macrocarpa*. Although two floral colours are to be seen, the commoner colour of the filaments is a deep red, and these smaller more richly coloured flowers on stalks which enable them to protrude beyond the foliage gives the plant a distinct advantage over *Eucalyptus macrocarpa*.

Eucalyptus rhodantha extends from the Hill River (where it is mixed with *E. macrocarpa)* to Gunyidi, some miles eastwards from Watheroo and southwards to near New Norcia. Its range is thus much more restricted than *Eucalyptus macrocarpa*, which extends from Mingenew to Kulin. It is worthy of note that *Eucalyptus Carnabyi* occurs with *Eucalyptus macrocarpa* at Barberton and Piawaning, and a form intermediate between the two is found not far from Bolgart.

The species flowers almost throughout the year.

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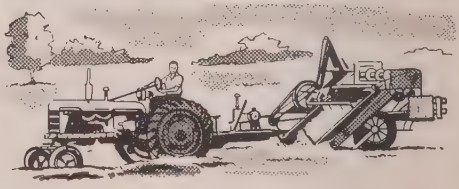

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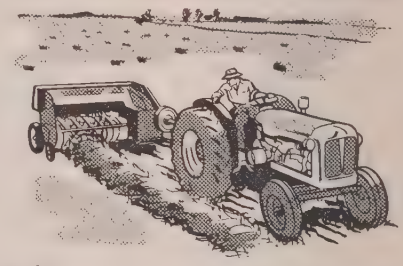

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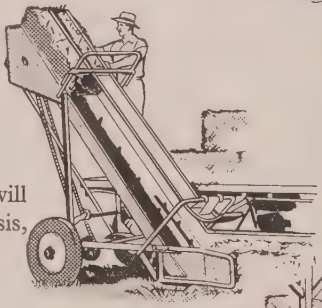

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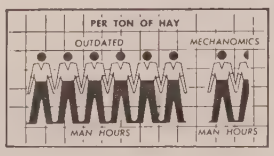

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Poultry Diseases in Western Australia

by

I. J. MILLER, B.V.Sc., Veterinary Pathologist

and

P. SMETANA, B.Sc. (Agric.), Poultry Adviser

POULTRY diseases constitute a major factor in losses sustained by the industry. It is the aim of this article to provide a ready source of information to assist the poultry farmer in understanding the common disease conditions that he is likely to encounter and to suggest possible means of control and treatment.

This article is not intended to take the place of a reliable diagnosis, which whenever possible is most important. Under certain circumstances however, when advice is unavailable, a list of symptoms and their age incidence, such as presented in the following pages, can help narrow down the possiblities and assist the farmer to recognise his particular problem. In this way prompt action may restrict what otherwise could become heavy losses.

Wherever possible treatments are suggested, but it should be appreciated that drugs and medications suggested are often available under a variety of trade names.

DIFFERENTIAL DIAGNOSIS OF POULTRY DISEASES

Diseases	Symptoms
RAPID DEATH	
(a) **Chickens.**	
Aspergillosis (Rare)	Fungal infection of lungs.
Chilling	Usually found dead in morning, evidence of huddling under brooder.
Crazy Chick	Occurs mostly between 9-21 days. Incoordination and unsteady gait with tendency to "back pedal."
Omphalitis	Swollen abdomen, inflammation of navel. Dead chicks usually foul smelling.
Pullorum	Heavy mortalities in first few days. Occurrence rare.
Coccidiosis	Usually seen at later stage, but if chicks have access to damp, contaminated litter then rapid deaths from loss of blood, will occur.
Uraemia	White, sticky diarrhoea, dehydration.
(b) **Growing Stock and Adult Birds.**	
Peritonitis	Odd deaths, due to infection of abdominal cavity, usually from oviduct.
Tick Fever	High temperature, greenish droppings, leg weakness, often high mortality. Birds die within 48 hours. Tick present.
LEG WEAKNESS AND PARALYSIS	
(a) **Chickens.**	
Perosis	Also called slipped tendon. Birds walk on hocks which are usually swollen. Legs turned out at an angle.
Curl-Toe Paralysis	Riboflavin deficiency. Involuntary inward curling of the hocks—chicks move about on their hocks.
Vitamin E deficiency	Incoordination, staggering gait. Early stage of crazy chick disease.
Vitamin D deficiency	Bones soft, rubbery, malformed.
(b) **Growing Stock and Adult Birds.**	
Botulism	Rapid death with peculiar kinking of the neck due to paralysis of neck muscles. Feathers easily removed.

Diseases	Symptoms
Bumblefoot	Large abscess on base of foot.
Fowl Paralysis	Symptoms vary from stilted gait to complete paralysis. Leg held at awkward angle, either trailing or perpendicular to body. Sometimes accompanied by wing drop on affected side and kinking of neck. Progressive wasting, birds dying in 1-3 weeks.
Tick fever	Leg weakness accompanied by green diarrhoea and fever.
Vitamin A deficiency	Leg weakness not uncommon. More characteristic in ducks.

DIARRHOEA

(a) Chickens.

Coccidiosis	Blood stained dropping (Caecal).
Pullorum	Whitish diarrhoea, rapid death.
Uraemia	White sticky droppings. Extreme listlessness.

(b) Growing Stock and Adult Birds.

Vitamin A deficiency	Droppings often loose.
Coccidiosis (Intestinal)	Droppings loose. No blood.
Visceral Leucosis	Result of a leucotic invasion of intestinal tract.
Tick Fever	Greenish diarrhoea.
Vent Gleet	Foul smelling diarrhoea. Vent inflamed.
Worms	Diarrhoea can occur where infestation of roundworm or tapeworm is severe.

WASTING, LOSS OF CONDITION

(a) Chickens.

Faulty Management	Incorrect brooding conditions, overcrowding, insufficient feeding facilities.

(b) Growing Stock and Adult Birds.

Fowl Paralysis	See leg weakness.
Visceral Leucosis	Mainly in birds 6-18 months of age. Gross enlargement of affected organs, i.e., liver, spleen, ovaries.
Severe Round Worm Infestation.	Birds show poor growth, loose droppings.

Diseases	Symptoms
External Parasites	Severe lice, tick or mite infestations. Irritation feather picking. Birds may be pale and anaemic.
Gizzard Impaction	Fibrous ball in gizzard often due to ingestion of long dry grass.

EYE AND/OR NASAL DISCHARGE

Growing Stock and Adult Birds.

Coryza	Discharge only slight, coughing sounds heard at night.
C.R.D.	Discharge more servere. Eye may be plugged with cheesy material.
Fowl Pox	Oculo-nasal form. Eye usually is closed and protruding. Occurs only in unvaccinated birds.
Vitamin A deficiency	In acute deficiencies the eye becomes swollen. Can be distinguished from above by white pustules in the throat and mouth.

DISTRESSED BREATHING

Growing Stock and Adult Birds.

Aspergillosis (Rare)	No gurgling or discharge from eye.
I.L.T.	No recent cases in W.A.
Vitamin A deficiency	Severe cases. Pustules in mouth and throat.
Fowl Pox	As above. Pox invasion of throat.

LESIONS ON HEAD

(a) Chickens.

Pantothenic Acid deficiency	Rare. Lesions on corners of mouth and eyelids.

(b) Growing Stock and Adult Birds.

Fowl Pox	Lesions may appear on any part of head but usually on comb. Wart like growths.

BLINDNESS

Growing Stock and Adult Birds.

Fowl Pox	Acute Ocular-nasal form. Only in unvaccinated birds.
C.R.D.	Coughing and gurgling present. Discharge from nostrils.

Diseases	Symptoms
Pearly Eye	Colour of eye abnormal. Blindness but no foreign matter in the eye.
Vitamin A deficiency	Swollen and discharging eyes. White pustules in throat and mouth.
INJURIES	
Growing Stock and Adult Birds.	
Cannibalism	Bare patches on body, sores evisceration, all caused by picking.
Prolapse	Oviduct protruding. Usually results in picking.
Bumblefoot	Abscess on ball of foot.

Diseases	Symptoms
PALENESS OF HEAD	
(a) Chickens.	
Coccidiosis	Huddled appearance. Post mortem necessary.
(b) Growing Stock and Adult Birds.	
Blackhead	Symptoms outwardly similar to coccidiosis, often occurs after fowl pox vaccination.
Round worms	Heavy infestation. Loss of condition, staggering gait.
Vitamin A deficiency	White pustules in mouth and throat.

ALPHABETICAL LIST OF DISEASES

The following list gives causes, control, and, where applicable, treatment for the individual poultry diseases. It should be used in conjunction with the differential diagnosis table.

ASPERGILLOSIS

This disease is due to a fungal infection of the lungs and air sacs, and when outbreaks occur they are often associated with straw litter. Conditions of moisture and humidity favour the fungal growth, but poor health and Vitamin A deficiency often predispose birds to infection.

The occurrence of Aspergillosis is rare in Western Australia, but outbreaks may be responsible for high mortalities. All age groups are susceptible, with affected birds showing symptoms of gasping and distressed breathing. The post-mortem picture reveals yellow-white nodules in the lungs, air sacs and often the oesophagus and crop.

Treatment:

Two per cent. copper sulphate (bluestone) in non metal containers for 14 days.

BLACKHEAD

This is a contagious disease of fowls and turkeys, caused by a protozoan parasite transmitted by the caecal worm. The classical form of Blackhead is more frequently seen in turkeys, although outbreaks in chickens can be responsible for quite heavy losses. Pullets may carry the organism without contracting the disease, but predisposing factors such as Fowl Pox Vaccination may precipitate an active infection.

Birds of all ages are susceptible but the eight to 18 week old group is more often affected.

Infected birds show listlessness, ruffled feathers and a yellowish diarrhoea. While post-mortem lesions are often absent in chickens, the typical ulcerated caecum and large cylindrical liver abscesses are invariably present in turkeys.

Control:

Eradication of the caecal worms is a necessary step, as they carry the infectious agents. In addition young stock should be isolated from older birds and turkeys, if kept, run entirely separately.

As the spread of this disease is hastened by moist, unsanitary conditions it is essential to have dry litter and hygienic methods of husbandry.

For treatment of outbreaks the drug of choice is "Entramin" fed in the water for a period of 14 days. This may be continued for a further period if losses persist.

Arsenicals and Furizolodane have also been found effective.

BLUECOMB

This condition has been known by a variety of names throughout the world, none of which accurately describes the disease.

"Bluecomb" as it is commonly termed in Australia, is basically a disfunction of the kidneys, resulting in retention of the toxic products normally excreted. The cause has never been defined, but the nature of its spread suggests an infectious agent.

Outbreaks have been seen in birds from six to 20 weeks old, but the commonest incidence is in pullets of the 12 to 15 weeks age group. The onset of Bluecomb is usually rapid with very little indication as to the cause. It is thought that various forms of stress may predispose to this condition and pullets approaching the point of lay seem very susceptible.

Affected birds deteriorate rapidly, becoming mopey and disinterested in either food or water. The body tissues become very dehydrated and a whitish watery diarrhoea, heavily concentrated with urates, is common. Mortalities may not necessarily be high, but if 50 per cent. of the flock became affected losses from the setback can be extremely serious.

The predominant post-mortem finding is a markedly pale, enlarged kidney with distension of the tubules by urates giving it a typically mottled appearance. The muscles and flesh assume a dry but sticky feel due to dehydration.

Control and Treatment:

As it is difficult to anticipate an outbreak of Bluecomb, it is essential to recognise the condition immediately it arises, and aim at limiting the spread.

In general affected birds must be given every consideration and disturbed as little as possible. Various forms of treatment have been tried, but 5 per cent. molasses in the feed or water, or antibiotics such as Aureomycin or Terramycin seem to give the best results.

BOTULISM

Not common in domestic fowls. Occurs when birds gain access to mouldy and decaying feedstuffs or organic matter, i.e., dead carcasses, decaying algae, or stagnant pools which contain botulinas organisms. These organisms produce a powerful toxin, which when ingested results in progressive paralysis and is invariably fatal. The birds are usually found lying with body extended and the neck flexed at an acute angle. This paralysis of the neck is referred to as "limber neck." In addition there is usualy a watery diarrhoea. Post-mortem examination shows no significant changes.

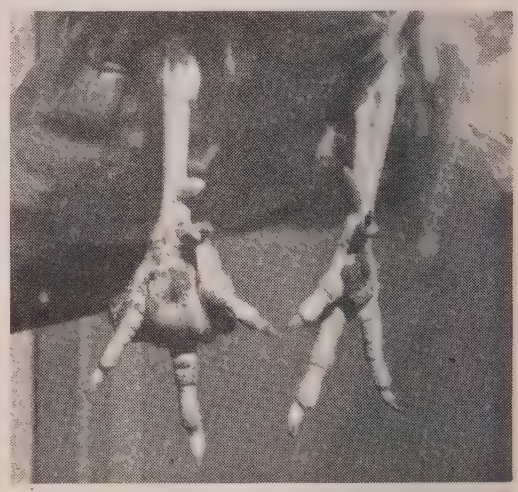
Control:

Remove all dead carcasses as quickly as possible and eliminate potential sources of the original infection. i.e., decaying vegetable or organic matters.

Treatment is of little value, although Epsom salts as a purge may aid the recovery of mild cases. Dose rate of 1 lb. of salts for 75-100 birds in the feed.

BUMBLEFOOT

The cause of bumblefoot has not definitely been established but is thought to be due to bacterial infection, probably following injury to the foot pad.



Bumblefoot: A typical case

Its occurrence is usually sporadic with only the odd bird becoming affected.

The lesion is in the form of an abscess on the ball of the foot, occasionally spreading along the toes. The subsequent swelling and lameness may result in a fall in egg production and progressive deterioration in condition.

Control:

Avoid the use of coarse, poor quality litter, and ensure that the perches are not too high.

Treatment:

The only logical treatment is to lance the abscess and gently squeeze out the pussy contents. As this may have to be repeated it may be more convenient to market affected birds.

CAECAL WORMS

These are small, whitish roundworms from ¼ in. to ½ in. in length, found in the caecum. Infestations are quite common, and in the majority of cases show no obvious effects. Occasionally with extremely heavy burdens of caecal worm, they may cause inflammation and thickening of the caecal wall. Their importance however, lies in the fact that they may harbour the organisms of Blackhead, so their elimination is desirable.

Treatment:

Phenothiazine at the rate of ½ grammes a head given as a medicated mash, is an effective form of treatment.

CANNIBALISM

The vice developed by poultry whereby they peck at one another, often inflicting serious injury. Common sites affected are the vent, toes, comb and feathers. When the vent is attacked with subsequent penetration of the abdomen, the intestines may be pulled out, resulting in immediate death.

Many theories have been put forward as to the cause of cannibalism, all of which may play a part. The majority of outbreaks, however, are seen in intensively run birds, where faulty management and overcrowding predispose to the habit.

Control of cannibalism can be aided by providing a well balanced diet, adequate in roughage, by avoiding overcrowding and promptly removing birds which show a tendency towards cannibalism, eliminating shafts of light that may shine into the brooder house and by checking ventilation. Affected birds should be treated immediately to prevent further attack.

CANKER

This is the condition referred to when fowl pox gains entry into the mouth, throat or wind pipe.

The affected birds become dull and listless, lose appetite and later develop a rasping cough. Examination of the mouth will reveal yellow cheesy material in the corners of the mouth and often occluding the windpipe.

Treatment of these cases is of very little use, other than mechanical clearing of the opening to the windpipe. Increased Vitamin A in the water or mash may assist recovery from the fowl pox infections.

CHILLING

A condition brought about in chickens by faulty brooder management or incorrect temperature control. If the temperature in the brooder is too low chickens will usually be seen to crowd around the source of heat, whilst excess temperature will force them to migrate to the outer extremities of the brooder compartment.

Affected chickens are usually found dead with little or no indication of the cause.

Control:

Losses may be rectified by checking the brooder temperature regularly, ensuring that for the first three weeks the temperature is 95° F. allowing a 10° drop for each subsequent week of brooding. Also avoid draughts from faulty ventilation.

CHOLINE DEFICENCY

Not recorded in this State, but suboptimal levels may be responsible for growth reduction in broilers and production drop in layers. Choline deficiency has also been incriminated as a possible cause of Perosis in chickens.

CHRONIC RESPIRATORY DISEASE (C.R.D.)

C.R.D. is a severe respiratory disease caused by virus-like organisms. Not common in this State, although possibly undetected in some cases.

Early infections are characterised by a watery discharge from the eyes and nostrils followed by coughing, gurgling and general respiratory embarrassment. These symptoms are usually accompanied by a rapid drop in feed consumption and fall off in egg production. The sinuses frequently become involved, resulting in a caseous plug inside the eye. Mortality is rarely high, but the effects may linger

through the flock for a considerable period.

Control and Treatment:

Care must be taken to prevent the introduction of infected birds into clean flocks, and to maintain good husbandry.

Treatment with antibiotics such as streptomycin, aureomycin and terramycin has been tried with varying success.

Nitro-furanes are also said to be effective against the causitive organisms.

COCCIDIOSIS

This disease is still responsible for many losses in chickens throughout the poultry industry, although the advent of modern anti-coccidial drugs has done much to reduce its incidence.

Typical appearance of chicken suffering from coccidiosis

Outbreaks of coccidiosis are frequently associated with wet conditions, moisture and heat being the principal predisposing factors. This may be from rainy or muggy weather, overcrowding and faulty drinking fountains.

The two main types of coccidial infections causing mortality are the caecal and intestinal worms, caused by different species of the same parasite. At each site these coccidia invade the delicate inside linings, where multiplication results in rupture of the cells and the clinical picture so common to poultry farmers.

Caecal Coccidiosis

Most commonly seen in chickens from three to eight weeks of age. Affected birds appear dejected, with huddled appearance, ruffled feathers and blood in the droppings.

Intestinal Coccidiosis

Usually occurring in older birds, but has been seen to affect chickens as young as three weeks. The symptoms are similar to the caecal form, but blood is rarely seen in the droppings. The extensive damage to the intestinal lining interferes with the absorption of nutrients and the birds show a rapid falling off in condition.

Prevention and Treatment:

There are many drugs available today which if fed at preventative levels, will control coccidiosis under sanitary conditions. It is when the condition of the litter becomes such that the build up of infection overwhelms this protective action that higher levels become necessary. The drugs found effective are principally Nitro-furazone, Zoalene, Nicarbazin and sulphaquinoxaline.

CORYZA

This disease is widespread in West Australian flocks and may be aptly described as the "common cold" of poultry.

The cause is bacterial in origin, but may be often associated with other forms of respiratory disease. The onset of outbreaks may often coincide with such predisposing factors as overcrowding, worm infestations, Vitamin A deficiencies, and variations in the external environment, such as humid, dusty or chilly conditions.

The symptoms vary in their severity, from a simple nasal discharge and cough, to heavy mucoid discharges, sneezing and pronounced loss of appetite. Early signs of coughing are easily picked up at night.

In many outbreaks, losses are few, but the generalised "set back" experienced by affected flocks may have serious economic consequences.

Control and Treatment:

Unfortunately control is extremely difficult, contact between susceptible birds and carriers being unavoidable. The rigid avoidance of predisposing factors as described above, will do much to prevent outbreaks occurring.

Treatment can be effective if used early in the outbreak. Such drugs as Sulphathiazole (45 per cent.) at the rate of 2 oz. per gal. of drinking water for four or five days, or injections of Streptomycin and the broad spectrum antibiotics (Aureomycin and Terramycin) at 2 to 3 oz. per 10 gal. of drinking water, have proved curative if used promptly.

CRAZY CHICK DISEASE

(Avian encephalomalacia.)

This condition in chickens is due either directly or indirectly to a Vitamin E deficiency. Present day outbreaks are characterised not so much by an inadequacy of Vitamin E in the ration as by the presence of such factors as rancid fats or fish oils, which hinder the utilisation of Vitamin E in the chicken. With the apparent absence of such dietary factors, the possibility of increased requirements during periods of stress may be implicated.

Outbreaks commonly occur between the ages of nine and 21 days, after which the disease is generally self-limiting due to the reduced requirements of older birds. Affected chickens show a variety of symptoms ranging from dullness and lack of appetite to marked inco-ordination with "back pedalling," prostration and death.

In its simplest form this disease is prevented by adequate levels of Vitamin E in the diet and can be treated by the addition of synthetic Vitamin E or the inclusion of five per cent. fresh wheat germ. Crazy chick has been observed where the ration was well supplied with Vitamin E, and in this case the presence of varied fatty acids is thought to be responsible for the destruction of Vitamin E. It is possible that other factors are also involved.

CROP BOUND

(See impacted crop.)

CURL TOE PARALYSIS

(See Riboflavin deficiency.)

DE-PLUMING MITE

An external parasite which invades the feathered areas of birds, piercing the skin at the base of the quill. The resultant irritation causes the birds to denude large areas along the back and tail, frequently terminating in unthriftiness and non-productivity.

Control and Treatment:

Control can be extremely difficult and it may be advisable to cull affected birds. Treatment by dipping birds in a warm 0.1 per cent. solution of Lindane or spraying with a similar solution may be an aid to control.

EGG BOUND

This is the condition referred to when laying birds have difficulty in passing eggs in the normal manner. It is usually due to either oversized egg or a longitudinal rotation causing a blockage at the cloaca.

The hen usually appears restless or distressed, and the excessive straining may result in eventual prolapse of the cloaca. Birds on high energy rations seem prone to this condition.

ENCEPHALOMALACIA

(See Crazy chick Disease.)

ENCEPHALOMYELITIS

Or Epidemic Tremor.

This is a viral infection of the brain, primarily affecting young chickens. Although quite prevalent in the Eastern States, this disease is fortunately not common in Western Australia. Chickens of all ages are susceptible, but natural outbreaks are commonest in the rst two or four weeks of life. Mortalities from 10 to 50 per cent. have been reported, and recovered birds may continue to act as "carriers."

The predominant symptom of this disease is a fine vibrating tremor of the entire chicken, felt when held loosely in the cupped hand. Positive diagnosis can only be made on detailed laboratory examination.

There is no effective treatment for this disease.

EXUDATIVE DIATHESIS

This is another manifestation of Vitamin E deficiency, in which affected chickens show a characteristic accumulation of fluid in the subcutaneous, or under-skin tissues. In severe cases the swelling is obvious and the chickens stand with legs apart, reluctant to move.

Treatment:

As with Crazy Chick Disease, the diet must be examined for possible factors responsible for Vitamin E breakdown. In most cases the addition of wheat germ or synthetic Vitamin E to the diet will reduce the incidence.

FAVUS—OR WHITE COMB

Favus is a skin condition of fungal origin, the occurrence of which is rare in Western Australia. Although it is not of a particularly serious nature, the insidious spread through commercial flocks can be distressing.

The fungus firstly attacks the unfeathered areas of the head, especially combs and wattles and may spread down the neck to the body. The skin becomes scabby, and where the feathers are involved they pull out readily, leaving raised fungoid encrustations at the base.

Infection spreads rapidly by direct contact, so it is important to recognise the condition promptly and eliminate affected birds.

Treatment:

Isolate infected birds and treat lesions with tincture of iodine or one of the antifungal preparations.

FOWL PARALYSIS

This disease is one of the major poultry problems of the world and is responsible for heavy losses in West Australian flocks.

Although undoubtedly related to the general *leucosis complex* there is some controversy as to whether the causative agent is a virus common to all the variant forms of leucosis, or an independent agent. However, for the purposes of diagnosis we shall deal with each form as an independent entity.

All breeds of poultry are susceptible to Fowl Paralysis. Infection is usually contracted in the first five or six weeks from contaminated pens or direct spread from adult carriers. The most susceptible period for outbreaks in this State appears to be from 10 to 16 weeks, although cases are recorded from as early as seven weeks, and up to 20 weeks. Evidence from local investigation suggests that concurrent infections such as severe coccidiosis, or periods of stress pre-dispose to outbreaks of fowl paralysis.

Although paralysis of the leg is the most common symptom, the nerve supply to the wings, neck and proventriculus are also frequently affected. The progress of paralysis follows no set course and may

Bird suffering from neural leucosis or "fowl paralysis"

vary from a leg weakness and stilted gait in the early stages, up to complete paralysis with one or both legs stretched out at awkward angles from the body. The "splits" position, with one leg forward and the other trailing behind is commonly seen. Having once contracted the disease, affected birds fall away in condition and die in one or two weeks.

Prevention:

Due to the irreversible nature of this disease, treatment is out of the question. Therefore preventative measures such as strict isolation of chickens from adult birds, breeding from more resistant strains and the eventual development of a genetically resistant bird, are the only means by which the incidence of disease may be reduced.

FOWL POX

Fowl pox is another of the commonly occurring diseases of poultry. A virus has been incriminated as the causative agent,

A severe case of the cutaneous form of fowl pox

but the incidence of outbreaks has been markedly reduced since the inception of vaccination.

This disease may occur in birds of all ages, although young stock are most susceptible. This may be partly explained by the fact that older birds are usually resistant, having been subjected to attacks earlier in life. Poor management, overcrowding and Vitamin A deficiency appear to predispose to outbreaks. There are three main clinical forms seen in fowl pox infection, depending on the site and severity of infection.

(1) **Cutaneous form**—Where the small raised pox nodules are confined to the comb, wattles, around the beak and in the toes, affected birds usually recover after a short period of sickness accompanied by loss of appetite.

(2) **Diptheritic form**—Occurs when the pox gains access to the mouth and throat. Upon examination the inside membranes will be found inflamed and coated with yellow-cheesy material or "canker." This form is much more serious, as the affected birds are in grave danger of suffocation with the resultant blocking of the windpipe, and is usually accompanied by gaping or gasping for breath. Birds lose appetite completely.

(3) **Oculo-nasal form**—May accompany the diptheritic forms, with the eyes and nasal passages becoming swollen and blocked by cheesy plugs. Some confusion may exist between this form and other diseases such as Coryza, or Vitamin A deficiency.

Where chickens are infected before vaccination, mortalities may be over 50 per cent.

Prevention and Treatment:

Vaccination is the only effective method of preventing outbreaks of fowl pox. This is usually carried out at 12 to 14 weeks, as in young chickens the effects of vaccination are too severe. Even at that age some flocks experience a slight degree of reaction, which may be overcome by temporary treatment with antibiotics. In chickens under the age of six weeks temporary immunity may be obtained by vaccinating with the far less virulent pigeon pox vaccine.

Treatment in affected birds is of little value, although high doses of Vitamin A seem to increase the rate of recovery. The duration of infection rarely exceeds two or three weeks in any one bird, and recovered chickens remain immune to further outbreaks.

HEAT STROKE

This condition commonly accompanies summer heat waves, where no precautions are taken to reduce temperature. Affected

birds gasp and gape continuously, then die a convulsive death.

Prevention:

Adequate shade, or sprinkler systems on the shed roof.

IMPACTED CROP

This is due to the continuous ingestion of long, coarse indigestible grasses or weed. Pieces of hessian from brooder covers have also been incriminated.

The crop becomes distended and pendulous, preventing passage of the food to the gizzard. Death is usually due to starvation.

Treatment:

Emptying of the crop through a clean incision made in the wall is the only reliable method. Care in preventing access to fibrous materials will reduce incidence.

INFECTIOUS LARYNGOTRACHEITIS (I.L.T.)

I.L.T. is an acute, highly contagious respiratory disease of chickens. It is rare in Western Australia, but outbreaks were experienced in 1948 and 1954.

The actual cause of the disease is a virus spread directly in the fine vapour spray from the cough of infected birds. This accounts for its highly contagious nature. Outbreaks usually occur after the introduction of infected birds, or adult "carriers" into a susceptible flock. *This is one of the reasons for the embargo on importation of birds from the Eastern States, where the disease is quite prevalent.*

In the initial stages of an outbreak the disease runs a rapid course, with high mortality. This is especially evident in susceptible flocks, as would be the case in Western Australia.

Affected birds show a variety of symptoms depending upon the stage of infection. These are:

(1) **Acute Stage:**—Infected birds gasp, extend the neck in an effort to breath, and cough up blood stained mucous. In this stage birds die rapidly.

(2) **Chronic Stage:**—Birds tend to linger, still experiencing difficulty in breathing and showing the characteristic blood stained mucous; but in addition develop a cheesy deposit in the eyes, nose and mouth. Coughing may still be severe.

A percentage of these birds may gradually recover, but remain "carriers" of the infection.

Control:

The only effective means of control is by vaccination, which due to the carrier state of recovered birds, must be continued until a clean flock is built up.

LEUCOSIS

(See Fowl paralysis and Visceral leucosis.)

LICE

One of the more serious external parasites, if allowed to live and multiply to any extent.

Numerous species of lice affect poultry, but due to the similarity of control they can be considered as a group for practical purposes.

Their general appearance may be described as flat, elongated parasites, grey to yellowish brown in colour, about $\frac{1}{8}$ in. long and with biting mouthparts. The entire life history of lice is spent on the birds, the eggs being laid near the base of the feathers from where they hatch in clusters and after several moults emerge as adults.

The importance of infestations depends largely on the severity of the burden, but due to the irritation imposed by their biting habits, lousiness may cause poor condition and general unthriftiness. There is also some suspicion that they may be able to transmit tick fever organisms.

The spread is from bird to bird by direct contact.

Control:

Lice may be effectively controlled by the use of any of the recent insecticides. Of these DDT (5 per cent), B.H.C. (0.5 to 1 per cent.) and Lindane (1 per cent.) have all been found useful.

Older and less effective remedies include the use of Pyrethrum dust (10 per cent.), Sodium fluoride and the painting of perches prior to roosting with nicotine sulphate.

LIMBER NECK

(See botulism).

MANGANESE DEFICIENCY

Manganese is a trace element essential for the health, growth and production of poultry. Deficiencies of manganese result in poorly calcified egg shells and a marked fall in hatchability due to the death of chick embryos during the final stages of incubation.

In the chicken, deficiencies have been incriminated as the cause of Perosis or slipped tendon.

Prevention:

The deficiency disease may be avoided by including recommended levels of manganese sulphate in the ration.

MONILIASIS

This is another of the fungal group of diseases affecting chickens, under the general heading of thrush or mycosis. Infections of this type are rare in Western Australia.

Affected chickens show unsatisfactory growth, loss of appetite and weakness. Lesions are commonly found in the upper digestive tract—mouth, throat and crop, or greyish white thickening on the mucosal lining.

Treatment:

The use of copper sulphate (bluestone) in the water, at the rate of one teaspoonful to two gallons of water in non-metal containers, is generally recommended.

Overcrowding, together with unsanitary conditions, predispose to fungal infections, so should be strictly eliminated.

MYCOSIS

A general heading for fungal infections which include Aspergillosis, Favus or White Comb, Moniliasis and Thrush.

OMPHALITIS (NAVEL INFECTION)

This is a disease of chickens up to 10 or 12 das old, due to infection of the unabsorbed yolk sac or the tissues surrounding the navel.

The cause of infection is not clearly understood, but experimental work strongly suggests that the organisms gain access to the embryo whilst still in the egg, rather than the infection occurring after hatching.

The age incidence of outbreaks varies with the nature of the infection. Where the tissues surrounding the navel are involved, the mortality usually eases by the third or fourth day. However, if the yolk sac is the prime site of infection, losses may continue for seven to 10 days.

Symptoms show up soon after hatching, with numerous dead chickens and others dull, lethargic and weak. The foul smell of putrification is characteristic of omphalitis.

Treatment:

Due to the nature of outbreaks, treatment is rarely attempted. Where deaths continue for some days Sulphamezathine or antibiotics in the water may be beneficial. Prevention will be aided by thorough fumigation of the incubator between hatches, and disinfection of trays and so on. Fumigation may be carried out right up to the time when the eggs begin chipping.

PANTOTHENIC ACID DEFICIENCY

This is one of the less frequently occurring deficiency diseases, only one or two cases being encountered annually.

Outbreaks in young chickens are characterised by poor growth, rough

Pantothenic acid deficiency: A recent case from this State showing typical symptoms. Note lesions on eyelids and corners of beak, and rarely seen dermatitis of the toes

appearance and the presence of scabs at the corners of the mouth, on the eyelids and occasionally between the toes.

Deficiency in adult birds may cause a fall in hatchability.

Prevention:

Outbreaks should not occur if the diet contains such ingredients as bran, brewer's yeast, liver meal or lucerne meal, all of which are good sources of Pantothenic acid. The addition of calcium panthothenate to the ration will also overcome any chance of deficiency.

The requirements of Panthothenic acid are 2.5 milligrams per lb. for chickens, and 5 milligrams per lb. for growing birds and breeding stock.

PEARLY EYE

Another of the variant forms of leucosis, only odd cases of which are seen in local flocks.

The predominant symptom is a loss of pigment from the iris and distortion of the pupil. Blindness usually results.

PERITONITIS

This is the name given to infection of the lining to the abdominal cavity.

Losses from this condition are purely sporadic and occur either following penetration of the abdominal cavity, or secondary to some generalised infection.

PEROSIS (or Slipped Tendon)

This condition occurs in chickens either fed on a manganese deficient diet, or hatched from manganese deficient eggs. Outbreaks may also occur with the excessive feeding of bonemeal which interferes with the assimilation of manganese in the gut.

The early symptoms are retarded growth rates, with distorted development of the bones in the wings and legs. As this progresses the joints become swollen and flattened, resulting in the Achilles tendon slipping off to either side.

Affected chickens are unable to walk and may be seen to hop around on the hocks.

Prevention:

The requirement for manganese in chickens is about 50 parts per million, which may be adequately obtained by a level of four to seven ounces of manganese sulphate per ton of feed.

Strict attention should be given to breeders' rations, and to the level of bonemeal in chicken rations. Excessive amounts of calcium, phosphorus and iron raise the requirements of manganese. There is no treatment for chickens once the tendon is displaced.

POISONING

Under conditions of intensive or semi-intensive management, cases of poisoning are rare in poultry. Where birds are given freedom to roam aimlessly, however, access to rubbish heaps or toxic plants may occasionally lead to trouble. Of these, Mexican Poppy, Castor Oil plants and rhubarb have been known to cause death.

The only other possibilities of poisoning which come to mind are such things as overdoses of drugs (for example, Sulphaquinoxaline poisoning), careless use of insecticides (for example, Dieldrin poisoning) and excessive salt in the ration.

Treatment is usually out of the question in such cases, so care must be observed to prevent such poisoning from occurring.

PROLAPSE

Although of a non-infectious origin, prolapse in laying birds may occur quite commonly. Such a condition is usually due to excessive straining, with a breakdown of the tissues supporting the cloaca and oviduct. As a result the cloaca is everted and the oviduct becomes exteriorised. The usual causes of prolapse are overlarge eggs, aggravated by constipation and evisceration following cannibalism.

Treatment:

If in the early stages, the prolapsed portions may be washed down with disinfectant and gently replaced.

PULLORUM

This disease in the past has been responsible for mortalities of 80 to 100 per cent. in hen hatched chickens. Since the advent of Pullorum testing, however, and the supply of hatching eggs coming from only Pullorum free stock, the incidence of losses has been virtually reduced to nil.

If an outbreak does occur the course of the disease varies with the mode of infection. Where the eggs are infected very few embryos hatch out, but if the infection is contracted after hatching, mortalities may occur any time during the first 14 days, with a peak of losses at the third and fourth day.

The predominant symptom is rapid death, although sluggishness, huddling together and diarrhoea may be observed.

Treatment:

The causative organism has been found susceptible to sulphanomide treatment, but the disadvantage of this is that recovered birds may remain carriers and not be picked up until tested as adults.

Control of this disease has been achieved by rigorous blood testing programmes with the elimination of positive reactors.

RED MITE

Another of the external parasites which attack poultry, causing irritation and loss of condition.

The mites are extremely small but may be readily seen in heavy infestations. They usually attack the birds at night whilst on the perches and hide in the woodwork by day.

Red mite have been suspected of transmitting tick fever organisms.

Treatment:

Spraying with 3 per cent. Malathion has given good results in ridding sheds of Red Mite. An older remedy was the painting of the perches with Nicotine sulphate.

RIBOFLAVIN DEFICENCY ("Curl-toe Paralysis")

Riboflavin is one of the vitamins essential for growth and production, and although good quality greenfeed contains a moderate level, non-supplemented diets are in danger of being deficient.

The effects of Riboflavin deficiency are clearly displayed by poor hatchability, the embryos being dwarfed and deformed. In older chickens on a deficient diet the growth rate is impaired and a characteristic curling inwards of the toes occurs, forcing the chickens to walk on their hocks.

Riboflavin deficiency: Chicks in typical position. Note malformation of the feet which gives rise to the common name "curled-toe paralysis"

In adult hens there are no marked symptoms except a fall in egg production and an enlarged liver.

Treatment:

Deficient diets may be corrected by the addition of synthetic riboflavin, although liver meal, dried buttermilk powder, brewer's yeast, lucerne meal and fresh greenfeed are sources of the vitamin. Requirements for breeding birds and growing stock are between 1.6 and 2 milligrams per lb. of feed and for laying hens about 1 milligram per lb.

RICKETS

This condition is brought about by faulty calcification of the bones, allowing unchecked growth to result in deformity.

It is impossible to separate the state of rickets from a Vitamin D deficiency, calcium or phosphorus deficiency, or an imbalance between all three.

Affected chickens show sypmptoms of leg weakness, unsteady gait and poor growth. The beaks and bones are extremely soft, and may become grossly distorted.

With the amount of sunlight available in this State, rickets should be, and is, comparatively rare.

Treatment:

Rickets may be remedied by feeding high levels of Vitamin D for two to three days, together with at least 2 per cent. bonemeal in the ration.

As most Vitamin additives contain A and D3, and sunlight is plentiful, prevention of rickets should be no difficulty.

ROUND WORMS (Ascaridia Galli)

Round worms are the most prevalent form of internal parasitism in poultry. The worms themselves vary from one to two inches in length, are round, smooth and elongated. They inhabit the small intestine, but in heavy infestations may be found as far up as the gizzard. The economic importance of heavy round worm burdens is in the poor development of meat birds, delayed egg laying, loss of production in adult layers and the poor condition of birds generally.

Parts of intestines of bird infested with roundworms

Symptoms of severe infestations are loss of appetite, paleness of the comb, diarrhoea and occasional death due to mechanical obstruction of the bowel.

Treatment and Control:

Replacement flock should be routinely dewormed at 10 and 18 weeks. This may be done by the incorporation of Piperazine compounds in the mash, or in the water. In addition to this, care should be taken to avoid overcrowding, unhygienic conditions, feeding off the ground and so on—all factors which favour heavy infestation of round worms.

All birds should be de-wormed regularly where there is any suggestion of worms, or where the conditions favour their spread.

SCALY LEG

A condition of older birds, following infestations of leg mites. These minute external parasites burrow into the skin of the legs where they spend their entire life history, resulting in a proliferation and thickening of the leg scales.

Their spread from bird to bird is by direct contact, and is aided by dirty, unhygienic conditions.

Control and Treatment:

In commercial flocks it is best to cull affected birds, then spray and disinfect the houses to prevent recurrence. Treatment may be carried out by first scrubbing the scale and dirt off the legs with soap and water, then applying emulsions of either DDT (2 per cent.) or B.H.C. (0.1 to 0.5 per cent.).

SOUR CROP

This is a common term applied to the condition of the crop following fungal infections. Sour crop, however, can easily be provoked by the feeding of coarse, fibrous food quite apart from fungal infection.

Treatment:

Eliminate the cause and, if present, treat for fungal infection.

SPIROCHAETOSIS

See Tick fever.

STAPHYLOCOCCAL INFECTION

Although rarely diagnosed in this State, outbreaks may occur unrecognised.

As the name implies the cause of infection is a bacteria known as Staphylococcus, which is a common secondary invader in all animal species. Outbreaks may occur in chickens of all ages, resulting in septicaemia. The general symptoms are high temperature, scouring, dullness, loss of appetite and usually rapid death. There may also be some inflammatory swelling of the joints.

Treatment:

The use of broad spectrum antibiotics such as Terramycin and Aureomycin will generally be effective.

STICKFAST FLEA

One of the less prevalent external parasites since the advent of good housing and deep litter.

The flea attaches itself to the comb, wattles and around the eyes, causing intense irritation often resulting in ulceration.

Control and Treatment:

These must be carried out together if eradication is to be achieved.

The spraying of birds and sheds may be done with either 0.5 per cent. DDT or 0.25 per cent. B.H.C.

Provision of deep litter on cement floors, and careful scrutiny of introduced birds, should be aimed at in flea areas.

TAPEWORMS

These are flat, segmented worms found in the small intestine of poultry.

Heavy infestations cause loss of condition and a fall in egg production. The spread of tapeworm infestation involves secondary hosts such as snails and slugs, which eat the gravid segments passed out in the droppings.

Control:

This is difficult due to the presence of secondary hosts which are difficult to eliminate.

Treatment:

A recent compound has been found effective against the tapeworms, namely: —Dibutyl tin di laurate, which is sold under the trade name of "Killworm."

TICKS—FOWL

This is one of the most common and important of the external parasites in Western Australia. Ticks are oval in shaps, reddish brown in colour, and easily visible to the naked eye.

Ticks are nocturnal in habit, emerging at intermittent periods to feed on fowls until engorged with blood. During the day they drop off and seek shelter in cracks, crevices, or under pieces of wood. However, the larval form, or "seed-tick" remains attached to the birds for about five days, so may be seen during the day.

Besides having harmful blood sucking habits, ticks are also the main vector for tick fever organisms. Heavy tick infestations cause ill thrift, poor growth and fall in egg production, due to the tick worry.

Control:

The location of ticks can only be done by painstaking searching, best carried out at night. One should concentrate on cracks, crevices, under perches, etc., with the aid of a strong light. Occasionally they may be seen on the bird itself.

Once having established their presence the shed should be thoroughly sprayed with either malathion (at 3 per cent.) or B.H.C. (0.5 to 1 per cent.) paying particular attention to where the perches join the wall, and so on.

Debris should also be removed from the ground.

TICK FEVER OR SPIROCHAETOSIS

Tick fever is an acute disease of poultry, caused by the inoculation of Spirochaetal organisms into the blood stream.

Outbreaks are associated with the presence of insect vectors such as fowl ticks, red mite, and possibly mosquitoes, which spread the disease by mechanical transmission of blood from an infected bird into the blood of a susceptible one.

Symptoms develop approximately 48 hours after inoculation, coinciding with the rapid multiplication of the infective organisms in the blood. In the acute form, affected birds show a high temperature (110-112°), greenish diarrhoea and a varying degree of leg paralysis. Death usually occurs in 12 to 24 hours. Mortalities at this stage can be extremely heavy. In the milder, more chronic form of the disease the birds are generally depressed,

extremely thirsty and may develop diarrhoea and paralysis 12 to 24 hours later. A percentage of these birds will recover.

The characteristic post-mortem picture shows a grossly enlarged, mottled spleen, and often a similar change in the liver.

Control and Treatment:

The main line of attack must be aimed at eliminating the insect vectors. This may be done by spraying with 3 per cent, Malathion or 0.5 to 1 per cent. B.H.C.

Affected birds will usually recover after treatment with antibiotics such as Penicillin, Streptomycin, Aureomycin or Terramycin. Arsenical preparations also have been used with varying success.

URAEMIA OR URICAEMIA

As the name implies (uric acid in the blood) this is a condition whereby the waste products normally excreted by the kidneys are forced back into the bloodstream.

The cause of this is still uncertain. Similarities between this disease and Bluecomb suggests the possibility of a virus; while stress factors such as overcrowding, dietary deficiency, and temperature variations cannot be discounted. Imbalance of sodium and potassium salts is another theory recently suggested. The incidence of uraemia in chickens up to the age of four to five weeks, is high in this State, although one to three weeks seems to be the most susceptible period.

Outbreaks usually commence with a number of chickens found dead and others showing symptoms of listlessness, loss of appetite, dehydration and sticky white diarrhoea. Mortalities in young chickens vary between 10 and 50 per cent., but seem generally lower in older birds.

The post mortem changes are mainly confined to the kidneys, which appear very pale and swollen due to the tubules being packed with urates; but the tissues also feel sticky due to dehydration.

Treatment:

In heavy mortalities good results have been obtained with water soluble antibiotics, while medication of the water with 5 per cent molasses has also proved extremely beneficial. Adjustment of the sodium potassium ratio by either cutting down on salt or adding potassium chloride to the water, is another treatment which has been successful in some outbreaks.

VENT GLEET

Vent gleet is an apparently infectious condition (although the cause has yet to be identified) in which the cloaca and surrounding feathers become soiled by a sticky white discharge.

This disease appears to be spread from bird to bird by the cock. Affected birds do poorly, lay very few eggs and bear a characteristically foul odour.

Vent infection may spread to the rectum, with the intense irritation leading to excessive straining, protusion and cannibalism.

Treatment:

Removal of infected birds is recommended. If treatment is to be attempted, repeated applications with a 3 per cent. solution of chromic acid offers the best possibilities.

VISCERAL LEUCOSIS

This disease, like Fowl Paralysis, is an important member of the leucosis complex and is responsible for heavy losses in this State.

Leucotic lesions occur usually in birds from six to 12 months of age, although cases have often been recorded in younger birds.

The predominant symptoms seen in affected birds are loss of appetite, intermittent diarrhoea and progressive wasting, with birds dying in one to four weeks after the first signs being noticed.

The liver, kidney and spleen are the organs most commonly affected, but almost all portions of the body may become involved. Lesions vary from pale, greyish discolorations, to gross enlargement with the organs' normal appearance being masked by infiltration of leucotic cells. Once the lesions commence to grow to a stage which is impossible to predict, the disease is irreversible.

Treatment:

There is absolutely no treatment of any value.

VITAMIN A DEFICIENCY

This is one of the more important deficiency diseases of poultry, due to the high requirements for egg laying, growth and resistance to disease.

Birds of all ages are susceptible to Vitamin A or green feed deficiency, especially young pullets on the point of lay. Adult hens take longer for a deficiency to become evident due to their ability to withstand a deficient state for longer periods.

The first symptoms of Vitamin A deficiency are a general falloff in condition and diminished egg production. As the condition progresses the mucous membranes of the throat and food pipe become involved, followed by nasal discharge and accumulation of white cheesy material in the eyes. Leg weakness and an incoordinated gait may be seen in the terminal stages. Severely affected birds may have difficulty in breathing and develop a harsh, rasping cough in an effort to clear the throat. A distinguishing feature of this disease from other forms of throat infection is the ease with which the cheesy material may be removed.

Vitamin A deficiency: A fairly severe case. Note badly affected eye

Vitamin A deficiency: Oesophagus of bird affected with Vitamin A deficiency, showing characteristic white pastules

The characteristic post mortem changes, other than the appearance of the eyes, are the pustles which develop from the mouth right down the lining of the oesophagus to the crop.

Treatment:

Supplies of the Vitamin must immediately be boosted. Apart from the wide variety of synthetic preparations now available on the market containing Vitamins A and D_3, fish oils, carrots and green feed are all rich in Vitamin A.

VITAMIN D DEFICIENCY

This was outlined under the condition of Rickets.

Vitamin D deficiency: Malformation of the beak of a young chicken

VITAMIN E DEFICIENCY

See Crazy Chick Disease and Exudative Diathesis.

Vitamin E deficiency: A common position of young chick suffering from "crazy chick" disease

VITAMIN K DEFICIENCY

This Vitamin is abundant in normal commercial poultry feeds, so that deficient states are rarely seen. Several outbreaks were reported two or three years ago in chickens running on wire. This was explained by the inability of the affected chickens to eat their faeces, which are rich in Vitamin K.

Vitamin K is essential to the clotting process of blood, so symptoms of deficiency are clearly seen in haemorrhages of the muscles, on the breast and under the skin.

WATER BELLY

(Also known as Abdominal Dropsy)

This condition has only a sporadic occurrence in old birds, where the abdominal cavity becomes distended with fluid and forces the bird to adopt a "Penguin-like" position.

WHITE COMB

See Favus.

WORMS

See caecal worms, Roundworms and Tapeworms.

REFERENCES

We wish to acknowledge the information and in some cases photographs taken from the following texts:—

Diseases of Poultry.—T. Hungerford, B.V.Sc. H.D.A.

Diseases of Poultry.—H. E. Biester and L. H. Schwarte.

Poultry Handbook.—Rudolph Seiden.

Poultry Nutrition.—W. Ray Ewing.

Poultry Diseases.—B. F. Kaupp.

HAVE YOU REGISTERED YOUR ORCHARD?

The annual registration of orchards became due on July 1, 1961. Under the regulations even a single fruit tree must be registered.

Registration fees can be paid at:

Treasury buildings, St. George's Terrace, Perth, Monday to Friday, 9 a.m. to 4 p.m., until Friday August, 4.

Department of Agriculture, Jarrah Road, South Perth. Monday to Friday each week.

Fremantle: Water Supply office, Monday to Friday, 10 a.m. to 3.30 p.m., each week.

Midland Junction: Clerk of Court's office, 10 a.m. to 3.30 p.m.

All Country Districts: Clerk of Court's office, during July only.

Department of Agriculture officers will also collect fees at:

Kalamunda district office, Fridays, 9 a.m. to 4 p.m.

Harvey office, Mondays, Wednesday and Fridays, 9 a.m. to 4 p.m.

Brunswick Hall, Thurdays, 2 p.m. to 4 p.m.

Waroona office, Tuesdays, 9 a.m. to 4 p.m.

Pinjarra Court House, Fridays 10 a.m. to 3.30 p.m.

Mandurah Police Station, Mondays 9 a.m. to 4 p.m.

Registration cards are available from Road Board offices, Police Stations, Clerks of Court and most Post Offices.

CLOVER PASTURE AT WYALKATCHEM

There is very little chance of run-off or soil damage when the topsoil is protected by a clover pasture like this. The clover also builds up the fertility and structure of the soil, making it more absorbent and resistant to erosion damage. This pasture is on the property of Messrs. G. T. and L. G. Carter. The clover was sown in 1957, left pasture in 1958 and the paddock cropped in 1959. The photo shows the recovery of the clover pasture by September, 1960

MANAGE YOUR RAINFALL FOR MAXIMUM PRODUCTION

By J. E. WATSON, B.Sc., Adviser, Soil Conservation Service

HOW much would an extra inch of rainfall be worth to you? Much sloping land loses this much and more by run-off every year. The soil is the main asset of your farm, but your profits depend on how you manage the rain which falls on it.

WHAT HAPPENS TO YOUR RAINFALL?

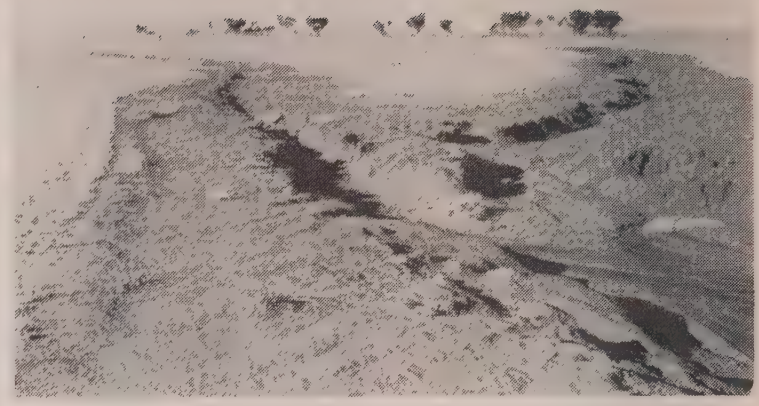
1. Do you let much of the early winter rains run off to the rivers? This is valuable water which should be used for early feed growth, or to wet the soil for early cultivation of land to be cropped.

2. Do you let water running off your property carry with it plant nutrients and topsoil which will silt up culverts, creeks, rivers and harbours?

3. Do you, on the higher slopes have insufficient rainfall for growing certain plants (e.g. sub-clover), whilst your neighbours lower down are complaining of flooding problems and a rising salt water table?

4. Do you, even within your own property, have higher slopes which are too dry, while lower slopes and flats are too wet?

5. Do you let millions of gallons run off your property during the winter and have a water shortage in summer?



SEVERE GULLYING IN THE EASTERN WHEATBELT

Even in the drier parts of the wheatbelt there are many examples of severe gully erosion. These gullies are caused by excess run-off from sloping lands. Once formed the gullies act as collecting drains which allow valuable rainfall to be quickly lost in addition to the soil which is washed out. With a system of contour banks the gullies can be reclaimed and run-off reduced and controlled

TO REDUCE RUN-OFF

As much rain as possible should soak in where it falls and be used there for increased production from better pastures and crops, Here's how to encourage this:

(1) **Keep a cover of vegetative matter on the soil for as much of the rotation as possible.** Rain drops hitting bare soil will dislodge fine particles. As the muddy water soaks in, these particles will block the pore spaces in the surface soil and reduce the rate of absorption. Grass cover will prevent this. Grass will also impede the downhill movement of the water, giving it more time to soak in. Dry grass left on the surface at the end of summer will allow rapid penetration of the first winter rains. The grass protects the surface soil from the drying action of the wind and sun; moisture loss from evaporation is reduced. Pastures will germinate early, and have a better chance of survival if a dry spell follows the opening rains.

(2) **Encourage and maintain good soil structure.** Topsoil with good structure will allow rain to soak through quickly and yet hold a maximum amount for later use by the plants. It will not get

CONTOURING SAVES RAINFALL AT DOODLAKINE

This sloping land was cropped on the contour by Mr. G. W. Henderson. After a heavy rain each combine furrow was left holding water which had accumulated because the rain fell faster than it could soak into the soil. As the furrows were level (i.e., on the contour) the water was held in them to soak in after the rain stopped. If these furrows had been leading downhill all this water would have been on the move—to be lost from the slope and possibly washing gullies and flooding lower land

waterlogged easily. A long period of pasture (clovers and grasses) between crops will improve the soil. Too much cultivation and cropping will damage the soil structure.

(3) **Cultivate on the contour to ensure that most of the furrows will be level.** When rain falls faster than it can soak in, the water collects in the bottom of the furrows. If the furrows lead downhill, the water will start to flow. Level furrows will hold the excess water and allow it to soak in after the rain stops. If harrows are used behind the combine, the furrows will not hold much water. If you don't use harrows, the contour combine furrows will have maximum capacity. They will keep the water where it falls. The furrows will still have some holding capacity in the pasture years.

More rain soaking in (plus superphosphate) means better pastures which create better soil structure which allows more rain to soak in which means better pastures . . . and so on.

TO PREVENT SOIL LOSS BY RUNNING WATER

The fundamental principle is to reduce run-off by getting most of the rain to soak in where it falls, as suggested above.

The second principle is to prevent water from concentrating and flowing in volume over cultivated soil. *When cultivating don't touch the grass which grows where water flows.* Leave natural flow lines uncultivated and protected by a dense grass cover.

Contour banks are used to intercept water flowing down the slope before it has sufficient volume and speed to erode the soil. The banks can be level and designed to hold and absorb all the water they

CONTOUR BANKS AT BEVERLEY

This photo shows a contour bank system in steep rocky country on the property of Mr. J. W. Woods. The contour banks intercept water running off the rocks and arable slopes. Previously the run-off had caused severe gullying on the lower slopes. The gullies have been filled and reclaimed and further loss of soil has been prevented by the protection of the contour banks. After absorbing as much rain as possible the banks discharge any surplus water into the well-grassed waterway in the centre of the picture. This waterway is never cultivated so that any downhill flow must take place on soil protected by a dense grass cover

intercept, or they can have a small gradient to move the surplus water slowly across the slope. This surplus must be discharged on to a grassed area (preferably a natural flow line) where it can flow downhill without causing erosion damage.

Banks are necessary when hazards such as rock outcrops rapidly shed water on to arable ground.

Banks make it safe to reclaim eroded land, by preventing filled gullies from washing out again.

Banks should be used if there are a number of flow lines in a paddock (where water can still concentrate in spite of contour working) and it is impracticable to leave them all uncultivated. The safest flow line is selected as a waterway and contour banks divert the run-off water to it from all of the other depressions.

STOCK WATER CONSERVATION

Improved absorption on the higher slopes can result in improved ground water supplies.

Contour banks can be used to divert run-off water from large areas to fill dams (earth tanks).

If you have stopped run-off from your farm lands, you can prepare special roaded catchments to fill the dams.

Soil and water (rainfall) are the key resources of an agricultural country. Keep them on your farm and don't let soil erosion rob you of your most valuable assets. Good pastures and contouring will help you do this.

THE PRINCIPLES OF DAIRY SCIENCE

"The Principles of Dairy Science," by Vanstone and Dougall, is a welcome addition to the general section of literature on the dairying industry.

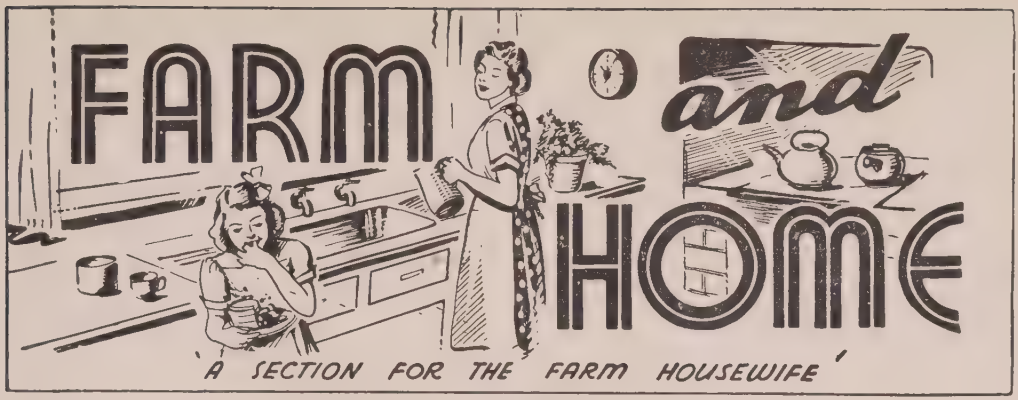
Literature for the dairying industry (together with all other industries) has become particular and precise with the onrush of technology, and it is pleasing to report that this book is of a broad enough canvas to cover—

(1) Feeding and management (under U.K. conditions, but of interest to Australian producers).
(2) Chemistry of milk constitutents.
(3) Manufacture of various products.
(4) Analytical methods to determine quality and standards.
(5) Some aspects of the law relating to the dairy industry.

It is an ideal book for students and others interested in dairying, up to about diploma standard. It is better than a lot of specialised books on the analytical material and diversity of tests for the purpose of the control laboratory, and contains much that is of general interest.

A useful appendix on British Standard Methods is included, the index is adequate and the table of contents well arranged.

—N. INGLETON.



A Top for a Teenager

By O. EVANS

WHEN a girl shows an interest in sewing, encourage her by allowing her to make something for herself. Choose something simple that can be finished quickly without Mother's help—a difficult, time-consuming article may cause a flagging of interest.

This pyjama top is one that has been made by many teenagers in metropolitan High Schools. Some choose a plain material and trim the finished garment with embroidery or applique, while others use a striped or geometrically patterned fabric with a plain material or material on the cross grain for trimming. The top can also be used as a casual or sports blouse, worn with shorts or "stovepipes."

Measurements and Material Required.

The only measurements necessary are the bust measurement and the length of the top, measured from the nape of the neck to the desired length.

A straight rectangle of material twice the length of the top plus 1 in. in length, and half the bust measurement plus 4 in. wide, is needed for the top, and a 13 in. square is needed for the neck facing. Machine a narrow hem across each end of the material and machine neaten the two long sides (i.e., fold under $\frac{1}{4}$ in. and machine down.)

Cutting the Neckline.

Fold the large piece of material in half, lengthwise first, then in half across.

Front Neckline.—(See Fig. 1) from A measure out 3 in. towards C. From A

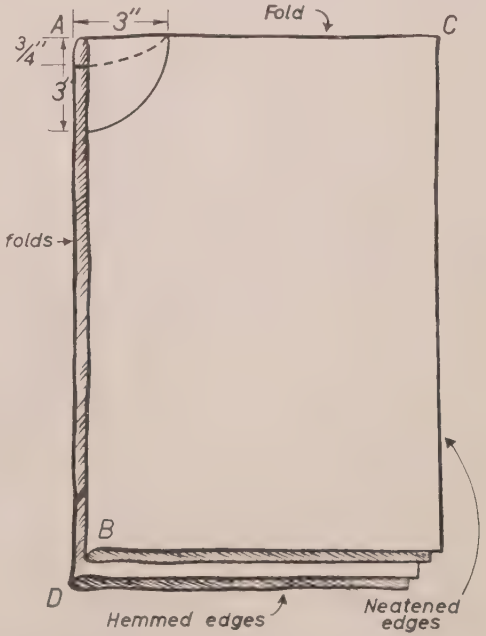


FIG.1 CUTTING THE NECKLINE

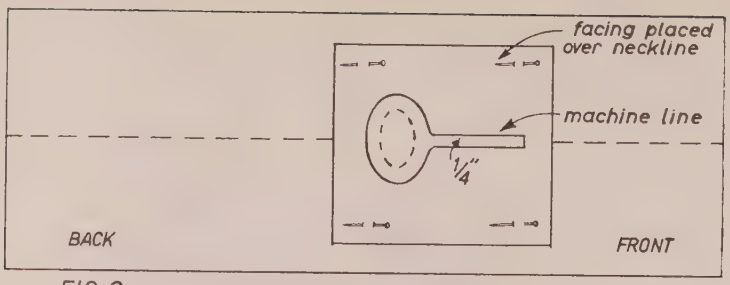


FIG. 2 MARKING DIRECTIONS FOR MACHINING

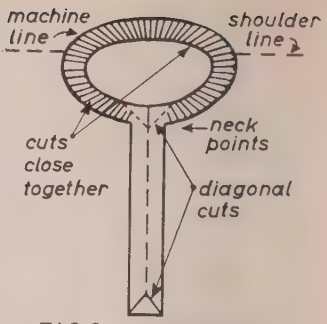


FIG. 3 THE NECKLINE

measure down 3 in. towards B. Connect with a curved line, using pencil or chalk.

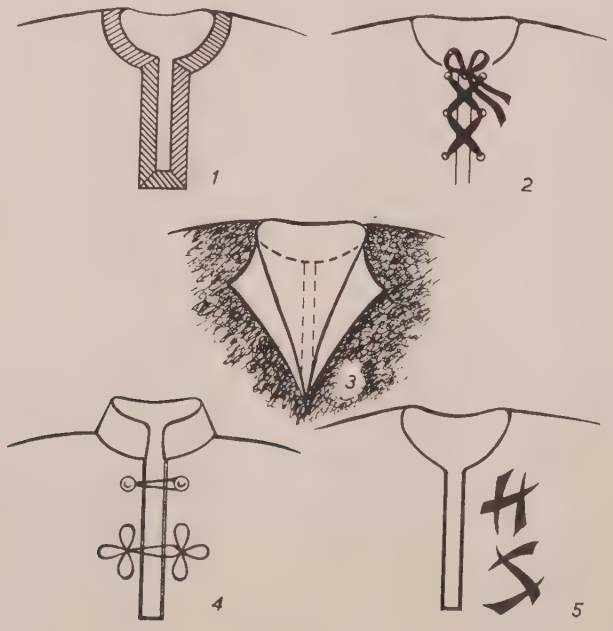
Back Neckline.—Turn material over, retaining its folds, and measure $\frac{3}{4}$ in. down from A towards D. Curve to 3 in. along A C. Open out the crosswise fold and cut out $\frac{1}{2}$ in. inside the line to allow for turnings.

Facing the Neckline.—Invisible finish. Place material opened out flat on the table with right side upwards, and place the facing material, right side down, over the hole for the neckline. There should be the same amount of material each side of the neckline. Allow $2\frac{1}{2}$ in. to 3 in. above the back neckline. Check that the straight grain of the facing is parallel to that of the garment, then pin corners and tack in place.

Mark machining line as in Fig. 2. Do not cut the neckline slit yet.

Machine around neckline and slit, keeping corners sharp and curve smooth.

After machining, cut out the facing material covering the neckline and nick the seam turnings into the machine line at about half-inch intervals. Place cuts close together at shoulder line where curve is more acute. Cut carefully down the centre of the slit to within $\frac{1}{4}$ in. from the end, then cut diagonally to the corners,



right to the machine line. Remove surplus turning at neck point corners by cutting diagonally across (see Fig. 3). Bring facing through to wrong side and tack around neckline to hold machining line on the edge of the fold. Press flat and turn under the edges of the facing. Finish by slip stitching.

Ornamental Facing.

Place right side of facing material to wrong side of garment. Proceed as above and finish by machining close to the folded edge on the right side.

Alternative Neckline Treatments and Trimming.

The slit could be cut out ½ in. wide and instead of facing the neckline bind it with bias strips or ornamental braid.

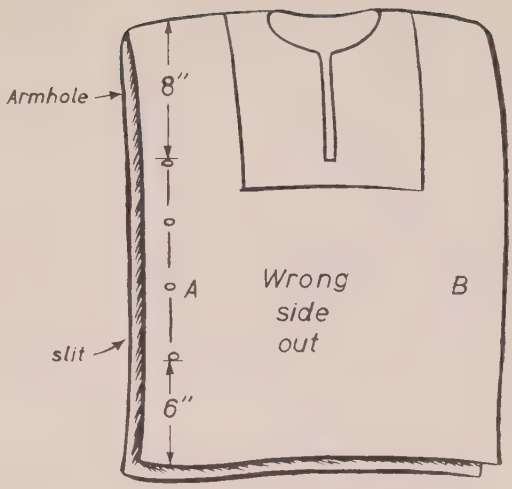
A straight mandarin collar could be cut to fit the length of the neckline. Face or bind edges of slit then attach collar so that raw edges of neckline are enclosed.

If a fastening at the neck is desired, hook and eye, buttons with thread loops, rouleau "frogs" or eyelet holes and cord can be used.

If embroidery or applique is being used, apply transfer or draw design at this stage. Chinese characters or pictures can be found on Mah Jong or Chinese Checkers sets, Willow pattern china, Chinese recipes, tourist folders china, pseudo-Chinese treatment of block capital letters could be done.

Side Seams.

Fold across in half, right sides together, and pin each side ready for fitting, leaving 8 in. from the shoulder for the armholes and 6 in. from the lower edges for the side slits (Fig 4). Try on, noting depth of armhole and width around body, and



A - pinned for fitting

B - machined

FIG.4 SIDE SEAMS

adjust as necessary then tack and machine the side seams, double stitching at the ends. The seam line should be straight and on the straight grain. Check that both armholes and both slits are the same length. Remove tacking and press seam open flat. The continuation of the seam turning forms the facing for armhole and slit—simply press, tack and slip-stitch. Re-inforce the ends of the side seams with arrowheads or satin stitch bars. The slits can be bound, ornamented with braid or laced as in the neckline slit.

This top could be made for a younger child — make the neck and armhole measurements smaller—and it would also be suitable for selling at fetes. Being perfectly straight and flat it is not suitable for a well-developed figure.

AN EMBROIDERY MOTIF

THIS design is very popular among schoolgirls making the Chinese style pyjama top described. It would also be suitable for tray cloths, cushion covers, guest towels, lamp shade covers, aprons, etc. The plaited pigtail makes an interesting note.

Use bright colours for the figure, using applique or outlining it in chain or stem stitch. Do long and short blanket stitch across the hems of the tunic and trousers to give an impression of a border. Brown satin stitch is suggested for the sandals and fishing rod, blue fading to mauve for the hills in the distance.

Pigtail.—Cut nine lengths of black ɪranded cotton or rayon thread (the ʼhole six strands) about 6 in. long. hread these one at a time on a darning eedle and make one ¼ in. stitch leaving in. of thread hanging each side of the ɪitch. Place these stitches in varying ositions so that when all nine lengths re attached they appear in a natural-ooking bunch. Make a plait, using three ɪrands in each section. Sew a coloured otton thread at the end to prevent un-avelling, then wind it around several mes and tie in a small firm bow. Trim nds. Applique or embroider the coolie at to hide ends of the cotton where ttached for pigtail.

If appliqueing the tunic and trousers over over the slits and embroider them n with stem stitch as it is too difficult to cut around such narrow strips with material. A small motif may be embroidered on the tunic if desired.

HINTS TO SPEED UP YOUR SEWING

WELL-MADE, attractive garments can be made in less time and without sacrificing workmanship and serviceability by simplifying sewing.

In addition to contributing to time-saving by selecting easily handled fabrics, simple but well designed styles, and the right sized pattern, much can be achieved by simplifying construction methods.

Too much attention to detailed neatening and finishing can sometimes spoil the whole effect of line and style of a garment.

The well-illustrated, step-by-step instruction sheet is one of the best aids to the home dressmaker. Each step is planned to ensure ease of handling and quick construction.

It is also a good idea to study one of the dressmaking books published by the various pattern-making companies. These are clearly and well illustrated, are revised frequently and are not too expensive.

Another aid is to observe the methods employed on ready-made garments; some of these can easily be adopted by the home dressmaker.

Eliminating all tacking is not necessarily time saving. At times it can result in a whole section having to be unpicked, reset, tacked and restitched.

Experienced dressmakers can, and do, save much time by pinbasting the simpler, more straightforward seamings.

Where time is short it is better to select fabrics, or styles, that require little or no trimming.

Buttons, provided they are washable, can provide a quick and effective trimming—alternatively, accessories can take the place of time-consuming appliqued trimmings. For children's wear flat trimmings, such as embroidered braids, are quick and easy to attach and are easy to iron.

Novelty embroidery stitches and simple, quick-to-make trims that give a professional look to an otherwise uninteresting garment may be made by many modern machines and attachments. For mothers of a young family this type of machine is a worthwhile investment.

N.S.W. Dept. of Agriculture

Honey Flora Calendar for August

COMPILED BY R. S. COLEMAN, APICULTURAL SECTION, WITH ASSISTANCE FROM THE BOTANICAL BRANCH

Common Name	Botanical Name	Where Found	Honey		Quality of Pollen	Flowering Time	Remarks
			Quality	Quantity			
Pindie or Pingli Bush	*Dryandra carduacea* Lindl.	Widespread on gravel soil	Fair to poor	Good to fair	Good ..	August to September	A good honey plant to build up bees in the Spring. Surplus honey available from strong hive.
Parrot Bush	*Dryandra sessilis* (Knight) Domin. - *D. floribunda*	Widespread seems to prefer shallow soils	Medium ...	Excellent	Good ...	Mid July to mid Oct.	It is the highest yielder of honey outside the eucalypts. Produces best in milder areas along the coast on limestone hills.
Fraser's Dryandra	*Dryandra fraseri* R. Br.	Gravel soils Coorow through to Great Southern	Good	Good	Good ..	Mid May to end of Aug.	This plant is very much like the Kerosene Bush of the north.
Yellow Dryandra	*Dryandra ippistiana* Meissn.	Gravel soils in Coorow-Dandaragan area, Midland sand plain	Poor ...	Good	Good ...	August to October	A spindly plant, not growing very tall with pale yellow flowers. Could be the plant that produces honey tasting like silage.
Fig Flower or couch Dryandra, Carpet Banksia	*Dryandra nivea* R. Br.	Widespread ...	Good	Good	Good ...	August to September	Variable plant, and this means its honey producing powers might also vary from district to district.
One-sided Bottlebrush Silky-blood flower	*Calothamnus sanguineus* Labill.	Widespread in sand plain	Poor .	Good ..	Very good	Mainly April to September	Grown on rocky ridges more often than sand.
No common name	*Leucopogon oldfieldii* Benth.	Widespread	Dark purple red honey	Good .	Good ..	July to August	Time of flowering is important to maintain hives in early winter and keep strength up for spring flows.
Wild Radish	*Raphanus raphanistrum* Linn.	Widespread weed	Good	Good ...	Good ..	June to August	Excellent plant to build up hives and in some districts a surplus of honey.
Cape Weed	*Crytostemma calendula* (Linn.) Druce	Widespread weed	Fair	Fair	Excellent	Late July to mid Oct.	One of the best pollen plants.
Salvation Jane, Patersons Curse, Vipers Vugloss	*Echium plantagineum* Linn.	Weed of agricultural areas	Excellent	Excellent	Excellent	Spring, Oct. to Nov.	Apparently needs a wet winter to produce.
White Bush Kangaroo Bush	*Hakea trifurcata* (sm.) R. Br.	Widespread	Poor	Good ...	Good	Late June to mid August	Important pollen flow prior to and builds up the bees for the Parrot Bush
Flooded Gum	*Eucalyptus rudis* Endl.	Wetter areas along watercourses	Good	Good	Good	Mid Aug. to beginning of November	Good strength building flow and if bees strong enough in the beginning will give two or more extractions.

Best Treat Sheep With

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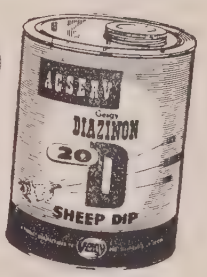
SHEEP DIP FOR PROTECTION AGAINST FLY STRIKE



Only "20D's" *deep-down* penetration gives the *lasting concentration in the wool* needed for maximum *protection.* Scientific tests *prove that Geigy Diazinon "20D" keeps moving down the wool fibres to retain this lasting protection.* Get the best! . . . insist on the Sheep Dip that does a *real* job . . . Geigy Diazinon "20D."

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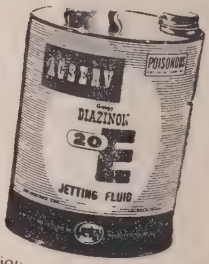
JETTING FLUID



Thorough jetting with DIAZINON 20E just prior to the fly wave will ensure protection for up to 14-16 weeks. Jetting with DIAZINON 20E in the middle of a fly wave will arrest fly strike. Graziers throughout Australia give full credit to DIAZINON in preventing a national disaster following the appearance of blowfly strains resistant to other materials. DIAZINON is still the only material which will control resistant flies and provide long-term protection.

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PLANTS AND ASTHMA

By R. D. ROYCE, Officer in Charge, Botanical Branch

ASTHMA is defined in the dictionary as being a disease characterised by recurring attacks of difficulty in breathing, and the causes are stated to include the inhalation of dust, or the odour of plants, flowers or animals. Hay fever is a similar condition and this too, is caused by plants, usually at the time of flowering, when large quantities of pollen are produced.

The great majority of plants are dependent on insects for the transport of pollen and the pollination of their flowers. A few plants, however, rely on wind currents for the transfer of pollen from one flower to the next, and in these species the pollen grains are light and sometimes winged, and are produced in vast quantities. These are the plants which are most often the cause of hay fever and asthma.

The native Sheoaks are species of this type and in the flowering season the male plants assume a distinct brown coloration with the masses of flower tassels at the ends of the branchlets. The native pines of the genus Callitris as well as the several species of Pinus cultivated in plantations are wind pollinated.

In a survey of the pollen load in the air carried out during 1947 by the Botany Department of the University of Western Australia in 11 of the suburbs of Perth, it was found that a little over half of the pollen collected was produced by pines and grasses. The effects of the clouds of pollen produced by pine plantations are well known in certain districts.

Among the grasses, the common couch is one of the most widely cultivated. It flowers regularly each year, and is a well known cause of hay fever. A great number of other grasses which share this distinction are widely naturalised in metropolitan and country districts. Prominent amongst these are the cereals; bents, bromes and fescues; barley grasses and rye grasses; paspalum and yorkshire fog. Maize with its large tassels of male flowers is a particularly prolific producer of pollen.

The widely naturalised sorrel and the equally abundant rib grass occur throughout the southern half of the State. Both are prolific pollen producers, and have been held responsible for attacks of hay fever. Other naturalised species include cape weed, which probably causes more trouble

in the agricultural areas, particularly the south-west, than any other weed species. The daisy family as a whole is, in fact, a bad one for asthma and hay fever sufferers.

Chrysanthemums are widely used as cut flowers, but in many homes they never find a place because of the very serious effect they have on susceptible people. Sunflowers too, are capable of affecting the health of these people, and the giant flowered type is known to be capable of causing discomfort to occupants of houses on the opposite side of the street Wormwood is an aromatic member of this group and one which is also known to be capable of causing trouble.

Privet, particularly the one which is grown for its abundant flowers, has been shown to cause hayfever under certain circumstances, but it is widely cultivated in gardens. Even the olive, cultivated over the centuries, has now been placed under a cloud by modern medical practice, and it too is suspected of causing hayfever. Again lucerne, the so-called "King of Fodder Plants" is suspect, as indeed is the lupin.

Most plants produce their effects only when in flower, but this is only partly true of some, as for example the silky oak. In susceptible people, asthma attacks can be induced by contact with the tree apparently at any time of the year, the mere act of climbing among its branches being sufficient to trigger off an immediate attack.

It is interesting to note that the same species of plant may cause different symptoms in persons of differing susceptibility. It is recorded that two youths who where assisting with the removal of a large and tangled plant of Tecoma from a suburban garden were both affected. One who had shown asthmatic tendencies on previous occasions quickly developed an attack, while the other became covered with a red rash.

The exact nature of these plant principles and their reaction with human beings is not clearly understood, nor, most probably, are all the responsible plants recognised as such. A great deal of work remains to be done in this field, and until then each case must be taken on its merits and investigated individually.

STORING VEGETABLE SEED

By W. H. KOOYMAN, Instructor, Horticultural Division

GOOD storage conditions are vitally important for retaining the germinating capacity of seeds.

Although the production of vegetable seed in Western Australia is limited, many local growers produce some seed of their own particular varieties and strains which are well adapted to the local environment. Stored on the property, these can soon lose viability if they are not properly treated.

Because seeds need a period of dormancy, the germinating capacity of seed of some vegetable varieties may increase during the first year of storage.

This may be the case with cruciferous seeds such as cauliflowers, cabbage and swedes.

However, the viability of most of the vegetable seeds rather decreases than increases in storage. In particular parsnip and onion seeds lose their vitality quickly, and sometimes after two years of storage their germination capacity may be lost altogether.

In recent months a number of complaints have been received about weak and poor germination of seeds which have been stored, particularly the self grown seeds.

It appears that many growers do not realise that several factors may affect the maintenance of viability of seeds in storage. Most important of these are:—

(1) Condition of the seed.
(2) Moisture content.
(3) Temperature.
(4) Condition and method of storing.

The condition of the seed greatly depends on the conditions under which the seed is grown, harvested and cleaned. Weakening may result from unfavourable conditions during ripening on the plants or curing and cleaning after harvest, so the age of the seed from harvest is not

always a reliable measure of ability to withstand further storage.

Most growers know that some seeds are injured more by mechanical means of cleaning than by careful cleaning by hand, and this is particularly the case with broad-beans, runner beans and other large seeds.

It has been found that micro organisms attack the seed at injured places, and injuries caused by threshing may be responsible for some loss of germination capacity during storage.

When storing vegetable seeds it should be borne in mind that seeds are largely made up of living material. Most seeds take up moisture quickly, or give it off to the atmosphere until equilibrium with the surrounding air is reached.

Increase of temperature or high moisture levels greatly increases the life activity of seed even though the moisture content is below that required for germination. As these activities take place in living material considerable amounts of energy are lost, with the result that the seed is gradually weakened and the germination capacity seriously reduced.

The speed at which life processes take place is low at low temperatures. It could be concluded that storage in a refrigerator is an obvious answer to preservation of the viability of seed.

However, although temperature can be controlled in this way, high moisture levels usually prevail and contaminating fungi may develop and cause injury to the seed. It has also been found that seeds removed from cool storage with high moisture content, then subjected to high summer temperatures, deteriorate so rapidly that in a few weeks the benefits of cool storage are lost.

Storage conditions are poor on many gardens. For example, high moisture levels may be induced by washing and packing of vegetables near where seed is stored.

The best storage for seed is in a cool, dry, well ventilated place. Seeds packed in cloth, paper, or hessian bags should not be stored in lofts or close to roofs, as high summer temperatures and condensation water may cause deterioration. The possibility of damage by insects and rodents should not be overlooked.

Screw top jars or airtight containers are ideal for storage of small lots of seed. As low moisture content is important, it is recommended to dry the seed in thin layers in a well ventilated place. The development of contaminating fungi may be prevented by dusting the seed with a commercial fungicide. The seed should then be placed in the containers and stored in a cool dry place.

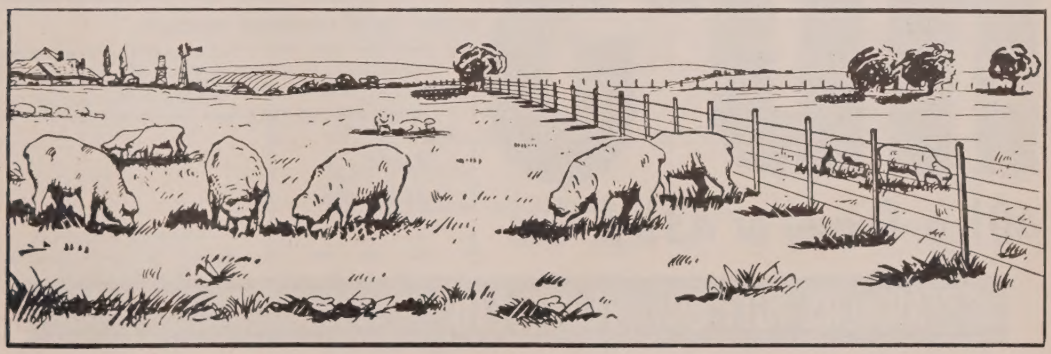
A new development in preservation of viability is the introduction of vacuum packed seeds, and seeds packed in laminated tin foil.

With each method the newly harvested seed is cleaned and dried carefully to a standard moisture content after which it is placed in air and moisture proof containers and sealed under vacuum.

The advantage of vacuum packed seed over ordinary seed is the avoidance of moisture fluctuations.

At present a wide range of seeds is available, in either cans or laminated tin foil. There is also a wide choice of packs to suit the requirements of the grower.

Although this development has solved some of our storage problems, growers are reminded that the advantage of sealed storage is not retained unless the sealing of the pack remains unbroken.



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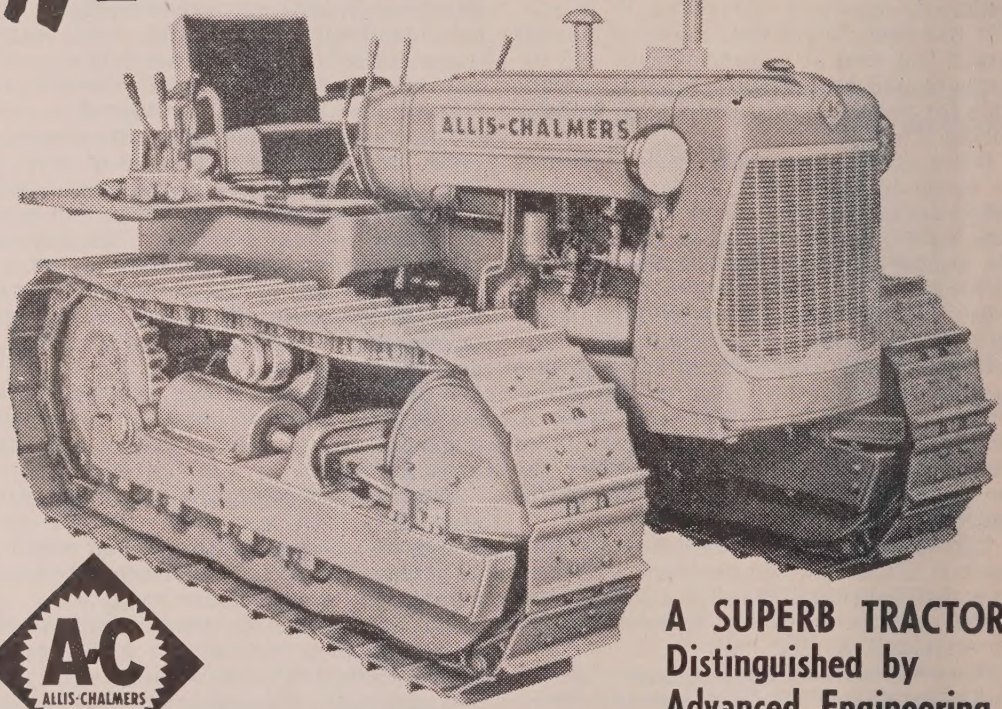

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